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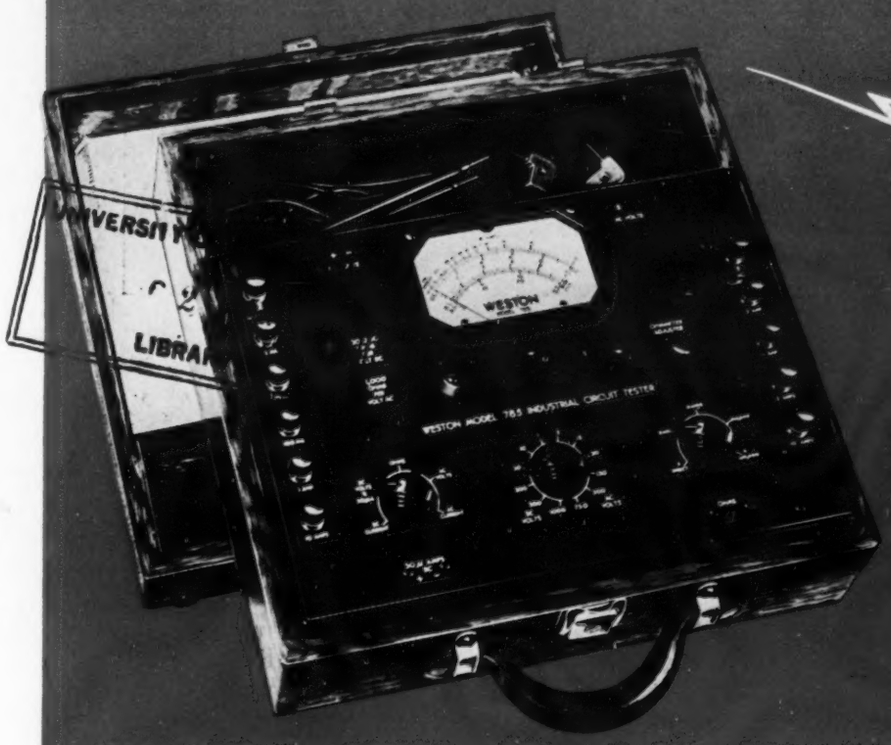
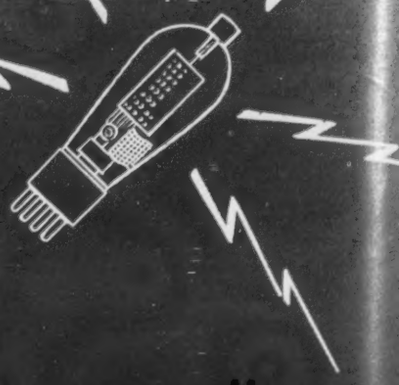
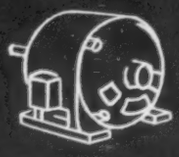
MEASURES THE *new* MAINTENANCE VALUE





as well as the old . . .



Weston MODEL 785 Industrial Circuit Tester

RANGES

D-C Voltage — *Measurements from 10 millivolts to 1000 volts (20,000 ohms per volt) in full scale ranges of: 1/10/50/200/500/1000 volts. (Up to 5000 volts with very compact external multiplier.)*

A-C Voltage — *Measurements from 0.1 to 750 volts (1000 ohms per volt) in full scale ranges of: 5/15/30/150/300/750 volts.*

D-C Current — *Measurements from 0.5 microampere to 10 amperes, in full scale ranges of: 50 microamperes, 1/10/100 milliamperes, 1/10 amperes. (Higher ranges with external shunts.)*

A-C Current — *Measurements from 10 milliamperes to 10 amperes, in full scale ranges of: .5/1/5/10 amperes. Higher ranges, up to 1000 amperes, with external current transformers.*

Resistance — *Measurements from 0.5 ohm to 30 megohms in full scale ranges of: 3,000/30,000/300,000/3 meg./30 meg. Center scale values are: 25/250/2,500/25,000/250,000 ohms.*

• The growing use of electronic devices and other s
tive circuits throughout industry poses no new in
ment problems for contractors or maintenance de
ments WESTON equipped. The familiar Model 785,
its high sensitivity and broad range scope, answers t
newer measurement requirements. But more . . . it
covers most of the *usual* maintenance needs.

Model 785 furnishes another example of WESTO
engineering foresight . . . designing instruments al
with the needs of *to-morrow* in mind. Other WESTO
equally important for efficient maintenance in the
to come, are the time-saving WESTON Clamp Amm
and the WESTON foot candle meters which measur
types of lighting direct . . . *without correction fac*
Weston Electrical Instrument Corporation, 578 Fre
huysen Avenue, Newark 5, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

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Specialized Test Equipment . . . Li
Measurement and Control Devices . .
Exposure Meters...Aircraft Instrument
Electric Tachometers...Dial Thermomete

FOR OVER 55 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMEN

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

November 13, 1943 — Vol. 120, No. 20

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To .....

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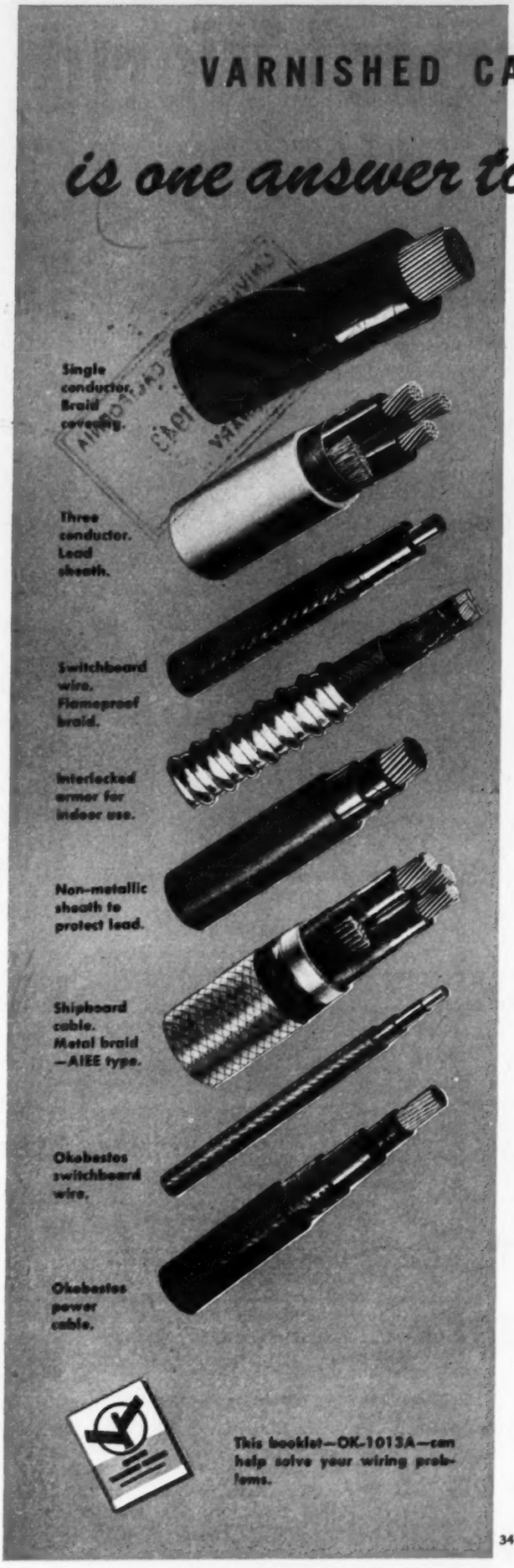
Signed .....

VARNISHED CAMBRIC INSULATION

is one answer to the rubber shortag


Single conductor. Braid covering.
Three conductor. Lead sheath.
Switchboard wire. Flameproof braid.
Interlocked armor for indoor use.
Non-metallic sheath to protect lead.
Shipboard cable. Metal braid —AIEE type.
Okobestos switchboard wire.
Okobestos power cable.
This booklet—OK-1013A—can help solve your wiring problems.

3417

A recent WPB ruling has forbidden the use of na rubber in the manufacture of electrical wire and c for most commercial purposes. To help satisfy wiring needs, why not consider the use of Varni Cambric insulated cables?

Okonite Varnished Cambric cables are *stable, l lived* and *easy to handle.* Resistant to heat, oil ozone, these cables can be used in power circuits either high or low voltages—for switchboard and trol wire—for generator or motor leads—and for m other applications. Okonite V. C. wires and cables made in either single or multi-conductor construc for all voltages up to 28,000 volts.

Insulated with oil-impregnated cloth, V. C. cable quire only a minimum of critical materials. In addi the higher permissible operating temperature of type insulation conserves copper by allowing hea current loadings for a given conductor size.

Okonite Varnished Cambric wires and cables ca supplied in a variety of suitable coverings—lead she wire or metallic tape armor, synthetic jacket, asbes or flame-retardant cotton braid. Bulletin OK-10 contains 36 pages of information on their select capacity and installation. Write today for your c The Okonite Company . . . Passaic, New Jersey.

VARNISHED CAMBRIC INSULATION IS N JUST ANOTHER WARTIME SUBSTITU

— yet it saves Copper, Tin and Rubber

Varnished Cambric insulated wires and cables were not developed as a stitute to meet a wartime emergency. Okonite has been a leading manu turer of a complete line of Varnished Cambric wires and cables since 1 For over 30 years V. C. cables have proved to be exceptionally rel and long-lived.

OKONITE

INSULATED WIRES AND CABLES

NOW COMES THE "EXTRA" DIVIDEND FOR USERS OF *Electroline*

RECLAIMABLE AUTOMATIC LINE SPLICES

LITTLE DID WE KNOW, these 12 years while we were saying, "Electroline Automatic Line Splices are reclaimable" that the really big story had not yet been told.

Now this important reclaimable feature scores again. Vital materials from which Automatic Line Splices are made are mostly off to war . . . so it is impossible to supply the quantity of line splices we would like to but your stock bins will supply splices for immediate requirements.

Every "out of service" line equipped with Electroline Automatic Line Splices is a source of supply. These splices are reclaimable.

Electroline Splices can be removed in a jiffy. Back they go to stock bins for re-use . . . time and time again. Stock without stock expenditures. How's that for an "extra" dividend?

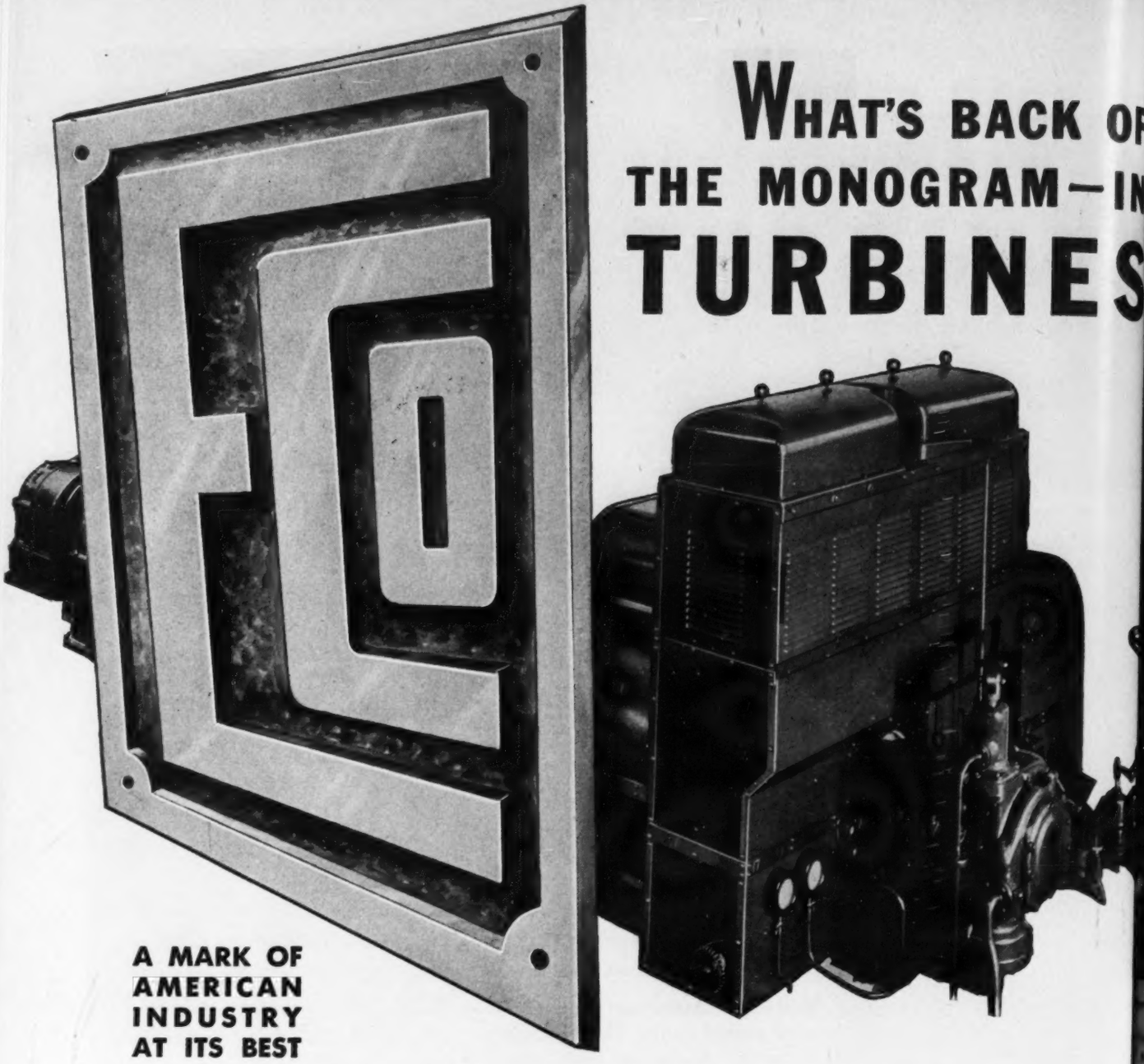
It is the everlasting quality of Electroline products that assures our users of adequate, effective usable Automatic Line Splices for the duration. The quality is there because long experience in this field has taught us how to put it there. Not only the first Automatic Line Splice, but also the first Reclaimable Line Splice came from the house of Electroline.

Electroline Company

Originators and Patentees of Automatic Line Splices and Dead Ends

4121 SOUTH LA SALLE STREET • CHICAGO 9, ILLINOIS

WHAT'S BACK OF THE MONOGRAM—IN TURBINES



A MARK OF AMERICAN INDUSTRY AT ITS BEST

THE answer is DEPENDABLE POWER—smooth, quiet, economical, reliable POWER to drive anything from a pump to a generator.

That monogram implies a background in turbine development going back to the beginning of the century. The progenitors of today's Elliott turbines first took shape almost forty years ago. Even then they were good units—some of them are still in service.

Elliott turbines today have adv to their present standard of exce through a process of conser development. The result is tu whose engineering integrity build fidence in every user.

When you need turbines—eit units with their generators, or f chanical drive—talk it over with

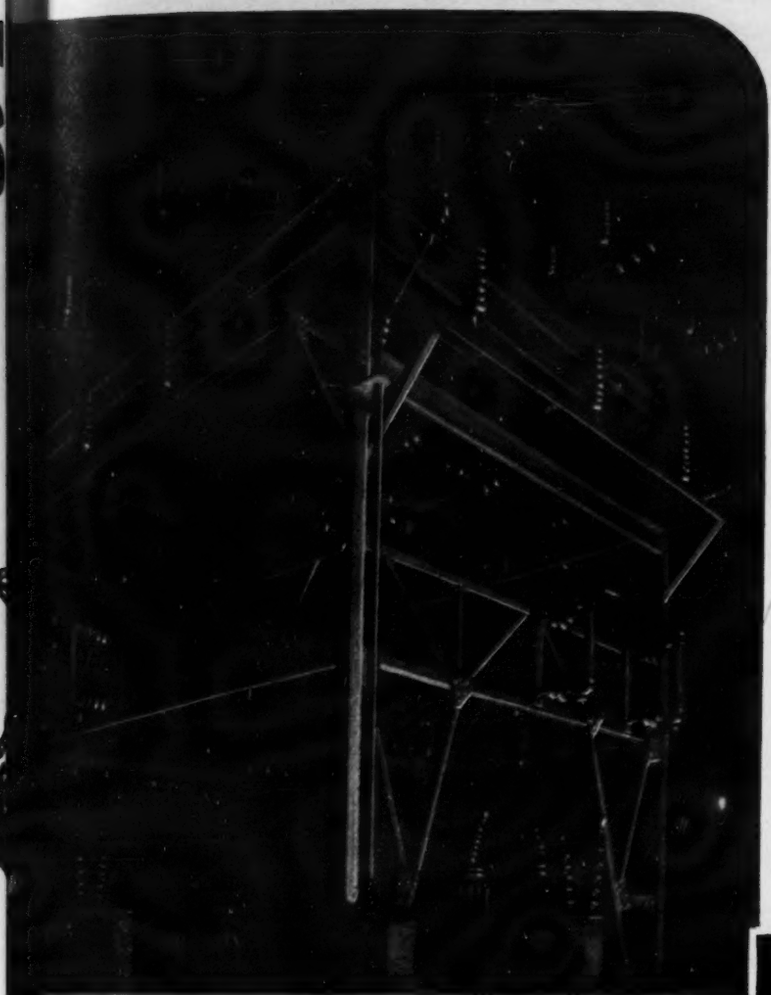
Steam Turbine Departmen
JEANNETTE, PA.
DISTRICT OFFICES IN ALL PRINCIPA

A star has been added to the Army-Navy "E" flags flown by both the Jeannette and the Ridgway plants of Elliott Company.

H-673A

ELLIOTT Compan

CHECK the FACTS on SERVICE IMPROVEMENT



1. Air switches, operated automatically, can perform many operations desirable for service continuity. They can be applied to a variety of switching schemes including many methods of automatic transfer, or automatic sectionalizing. They may be controlled, through relays, on any predetermined condition of current, voltage or frequency.

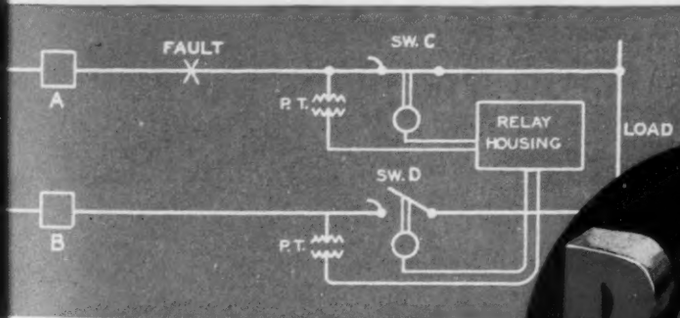
2. R&IE standard equipment—air switches, motor or spring mechanisms—has many distinct advantages for reliable operation. For instance, R&IE switches do not require slamming to close, and thus are especially suited for motor or spring operation.

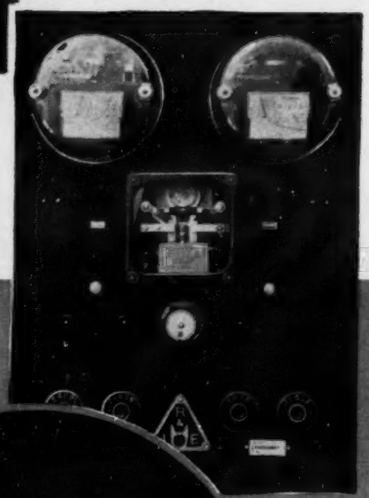
3. R&IE has complete facilities for the design and manufacture of control panels, switch mechanisms and complete mounting structures.

Typical control panel for automatic transfer installation.

an automatic transfer installation which has been in operation for several years.

is shown a typical schematic arrangement of two air-switches for the transfer ad from a faulty feeder to an emergency line. (1) Fault (at X) occurs, and (2) (A) trips open, recloses, trips again. Switch (C) trips open from undervoltage. (D) closes, restoring service. The load may be arranged to automatically to first feeder without service interruption.





Consult your R&IE representative with your automatic switching problems.

R&IE

Automatic AIR SWITCHING EQUIPMENT

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES LIMITED TORONTO

The Check List

- CONDUCTOR SUPPORT CLAMPS AND FITTING
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

PORCELAIN
PORCELAIN
PORCELAIN
PORCELAIN

Porcelain Dielectric Is The *Essence* of O-B BUSHING DESIGN

O-B bushings are distinguished by one feature--porcelain dielectric. Porcelain cannot be harmed by un-predictable discharges or leakage currents. Porcelain can't be altered by time in the slightest way. Porcelain is broadly conceded to be the most stable, rugged high-voltage insulating material... Porcelain insulation now carries the voltage to your sub-stations. Let it carry that voltage safely the rest of the way--right to the windings of your apparatus... Specify O-B porcelain bushings.

2413-H

Ohio Brass

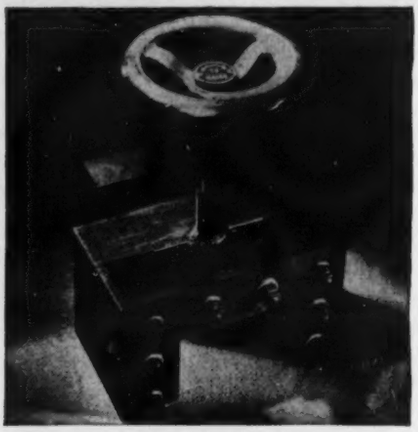
MANSFIELD, OHIO

CANADIAN OHIO BRASS CO. LTD. NIAGARA FALLS, ON

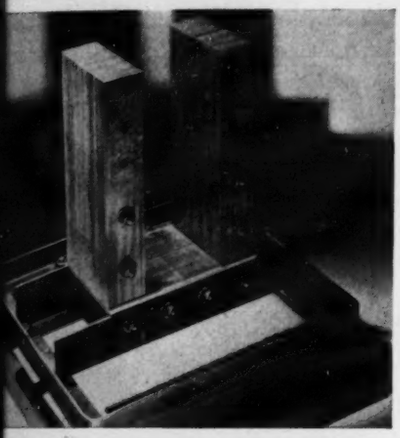
HERE'S THE NEW AMPAC '400' TO SAVE YOU MONEY!

It's an *a-c* welder — with no arc blow! Capacity is 50 to 500 amps — *the* ideal size. Note how simple, rugged the new Ampac is...

2 Here's power! Transformer coil has oversize rectangular winding—glass-insulated — with primary over secondary. Air duct prevents breakdown.

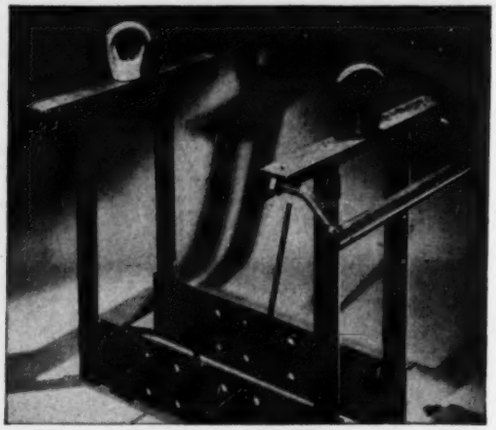


3 One inch movement of upper core — only 7 easy turns of wheel — covers entire welding range! Result: less wear, time saved!

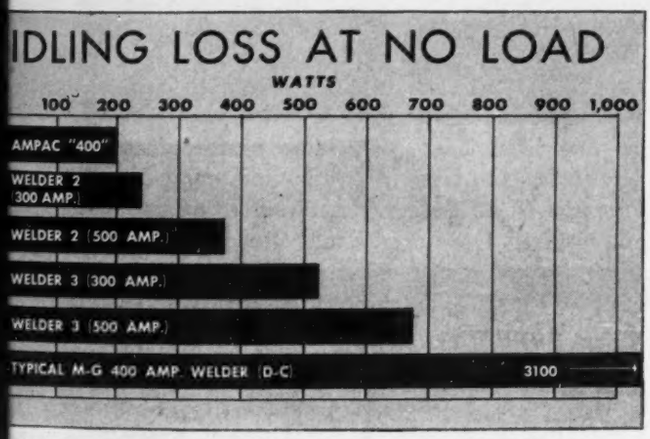


Lower core is 1-piece, U-shaped, die-punched silicon steel. Eliminates air gaps, cuts idling loss. Note 1-piece welded frame, heavy angles.

5 Extra heavy welding terminal will stand years of abuse. All permanent connections are *brazed!*



6 Sturdy lifting frame bolts to *core* for direct lifting of heavy mechanism. No load on case. Damage to case can *not* affect structure of electrical parts.


IDLING LOSS AT NO LOAD
WATTS
100 200 300 400 500 600 700 800 900 1,000
AMPAC "400"
WELDER 2 (300 AMP.)
WELDER 2 (500 AMP.)
WELDER 3 (300 AMP.)
WELDER 3 (500 AMP.)
TYPICAL M-G 400 AMP. WELDER (D-C)
3100

Compare Ampac with the 2 largest selling a-c welders and a typical d-c welder. At 2¢ per kw/hr, the d-c unit wastes $1.49 in a full day; Ampac's loss is less than 10¢! *And* — Ampac is more *efficient* than these welders! A 1665

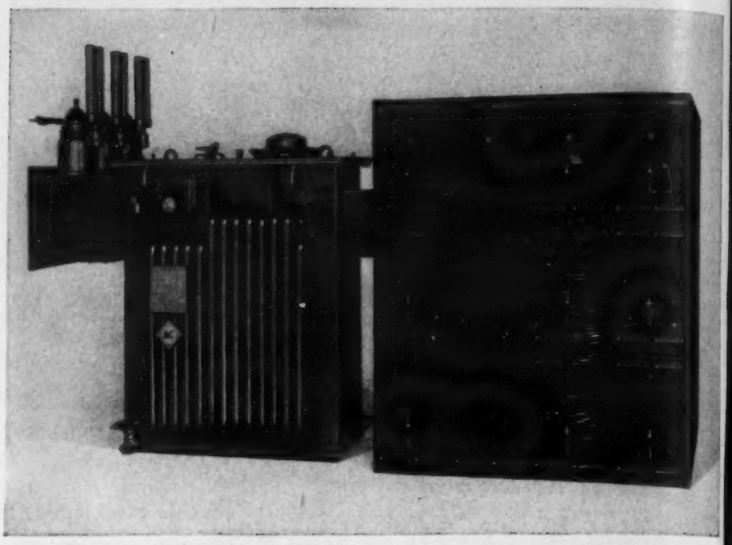
IT WILL pay you to get the full story on these brilliant new Ampacs. A new, patented circuit increases efficiency, cuts operating costs. Available in 200 amp units and up. Write for bulletins B6241, B6302.

ALLIS-CHALMERS

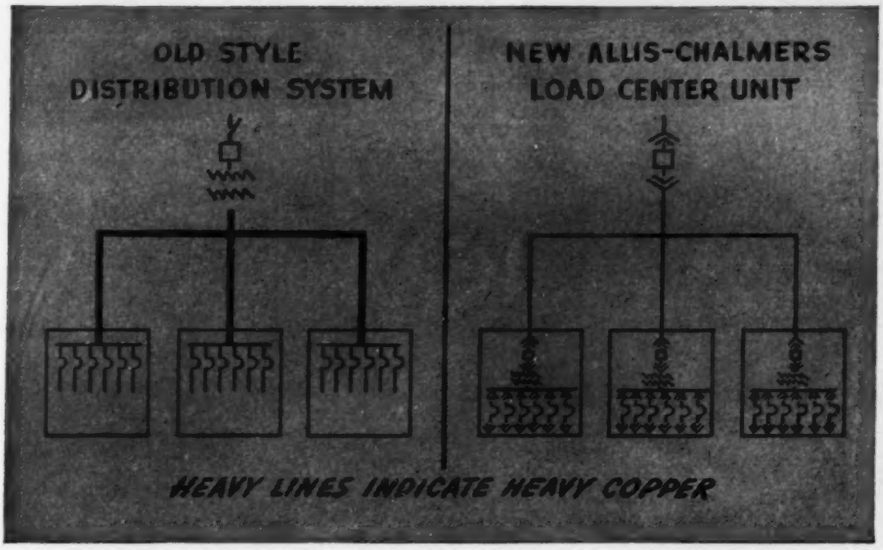
MILWAUKEE, WISCONSIN

Profits Come

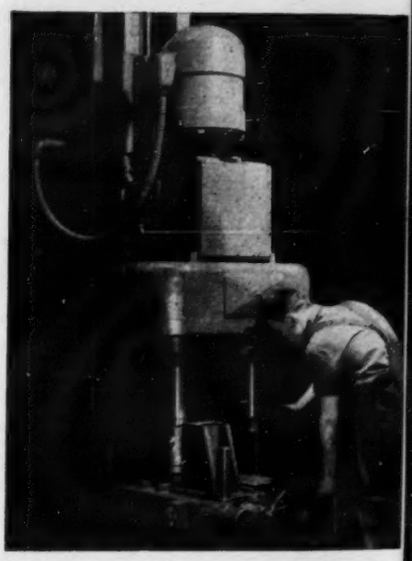
Packaged design of the new Allis-Chalmers Standard Load Center Unit Substations brings profits to you through shorter deliveries, faster installation, increased production. You also gain in floor space saved . . . in improved motor performance!



1 ***Faster deliveries!*** Uniform construction of Allis-Chalmers Load Center Unit Substations means savings for you in drafting room and shop time. Yet these units are completely adaptable to the requirements of your plant.



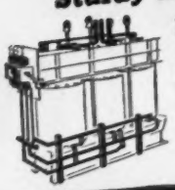
4 ***Big copper savings!*** Installed right at the machines they serve, Load Center Unit Substations reduce length of heavy secondary leads. You save money for your company, as well as precious copper for the U. S. And Chlorextol-liquid-filled or dry type transformers need no vaults!



5 ***Better performance!*** With lower losses and improved regulation you get better motor operation and lighting. Production is stepped up!

Check these Features..

Sturdy Lead Supports



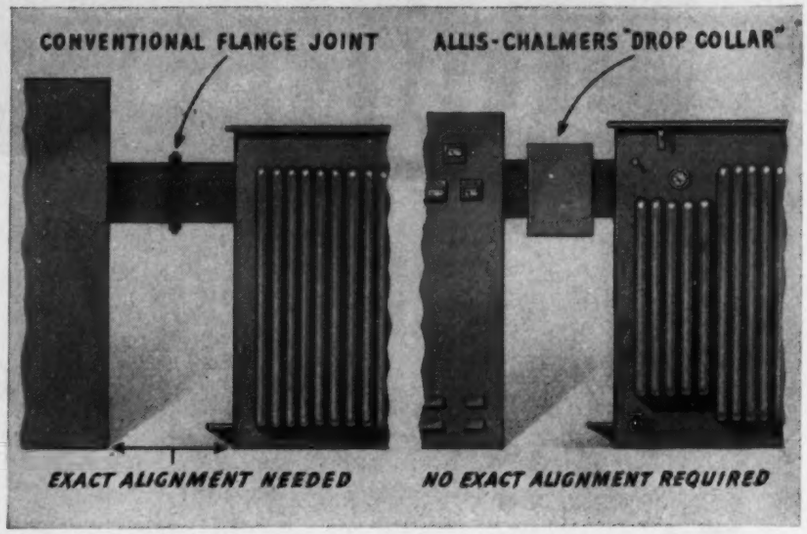
Rigid, braced supports hold leads securely in position during stresses caused by system short-circuits. Wide spacing of leads increases electrical strength.

"Feather-Touch" Control

Large Unit Substations having load-ratio-control transformers are equipped with "Feather-Touch" Control . . . maintains voltage within narrow band widths.

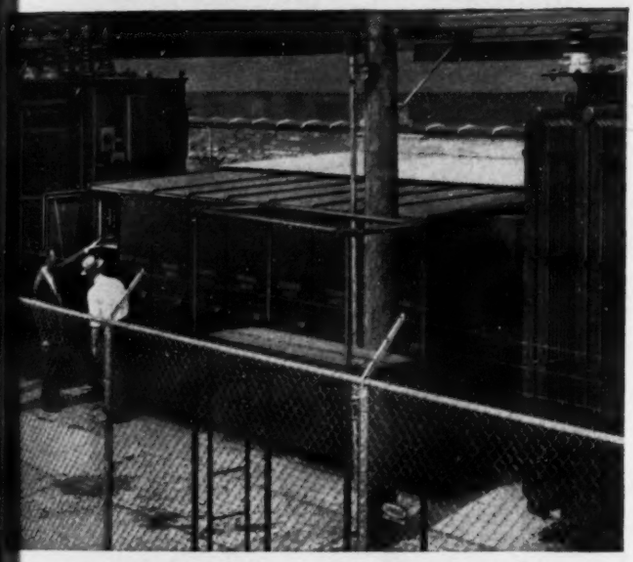
in Packages!

HIGH	LOW
1. DISCONNECT SWITCHES	1. STATIONARY AIR BREAKER
2. OIL FUSE CUTOUTS	2. DRAWOUT AIR BREAKER
3. METAL-CLAD SWITCHGEAR	(CAN BE ELECTRICALLY OR MANUALLY OPERATED)
4. DIRECT CONNECTION TO ROOF BUSHING	
5. LOAD BREAK SWITCH AND FUSE COMBINATIONS	



2 ***Flexibility!*** Note the wide variety of high and low voltage equipment you may choose from. Transformers are oil- or Chlorextol-liquid-filled or dry type.

3 ***Easier installation!*** Allis-Chalmers "drop collar" on out-door units and on high side of indoor units means no flanges to bolt, no need for exact alignment at base. Flexible cable low-voltage connection on indoor units also saves installation time.



6 ***You save space*** thanks to the compact design of Allis-Chalmers outdoor Unit Substations. If the load center ever shifts, these modern units are handier to move. And that trim *appearance* is an asset!

ALLIS-CHALMERS
UNIT SUBSTATIONS

To learn why buying Load Center Unit Sub-stations is smart buying for *you,* call our nearest office. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 1649

Enclosed Wiring Channels

Control wiring protected by built-in ducts . . . affords safe, efficient operation of units. Large channels allow room for additional secondary control wiring, if needed.

Jig-Built Switchgear

Allis-Chalmers switchgear is built in sturdy jigs to assure uniformity. Accurate manufacture means quick installation, correct alignment, more satisfactory operation.

Longer Gasket Life

Extended tank wall on transformers protects cork gaskets from over-compression when cover bolts are tightened. This construction insures a permanent seal.

Utilities report o

Availability 99%
FOR ONE YEAR'S OPERATION

On the line-96.9%
OF TOTAL HOURS IN ONE YEAR

Forced Outage-16 hrs.
IN 21 MONTHS OF OPERATION

Availability-96.1%
FOR ONE YEAR'S OPERATION

On the line-97%
OF TOTAL HOURS IN ONE YEAR

Forced Outage-1%
IN 17 MONTHS OF OPERATION

On the line-98.2%
OF TOTAL HOURS IN ONE YEAR

8 Months
WITHOUT A SHUT-DOWN

On the line-99%
OF TOTAL HOURS IN 11 MONTHS

Availability 96%
FOR ONE YEAR'S OPERATION

wartime performance

of C-E units

One of the more impressive chapters of American industry's response to the war is certain to be written about the performance of the country's public utilities. For they have not only successfully met the enormously increased power demands of suddenly expanded industries, but they've also been able to supply all civilian needs despite the abnormal growth of many population centers.

This accomplishment is a composite result of several factors:—the traditional foresight of the utilities in planning additional capacity to care for normal growth before the need becomes acute;—the capability of utility management and personnel;—the reliable operation of power generating equipment.

Typical examples of the contribution of C-E Steam Generating Units to this record are given on the opposite page. Each statement is a brief summary of the report of a utility company on the wartime performance of its C-E Steam Generating Units. All of these units are serving industrial areas where uninterrupted service is vital to the ultimate victory of the United Nations. A-764

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

Official U.S. Navy Photograph

...BIDDLE INSTRUMENT REPAIR DEPARTMENT

These three "Megger" testers were on board the former liner *Normandie* when she capsized, were recovered after several months and sent to our Repair Department for whatever could be done with them. Although waterlogged and badly corroded, as shown here, we found they could still be salvaged. They were repaired, rebuilt and returned to service, practically equal to new, within three weeks' time—a tribute both to the inherent quality of "Megger" instruments and the craftsmanship of Biddle instrument makers.

For many years we have maintained an Instrument Repair Department for servicing, repairing and rebuilding "Megger" Insulation Testing Instruments, Tachometers, Frequency Meters and other specialties. Today this well-equipped and busy department is not only servicing equipment we have supplied, but also other types and makes of instruments.

Perhaps you have instruments lying idle that need only expert repairing to return them to service. If you are faced with difficulty and delay in procuring replacements, our Repair Department may be able to help you.

THE NEW . . . U. S.-MAD
"MEGGER" INSULATION TE

in plastic molded case; with the herit ruggedness and accuracy common to all ments bearing the trade mark name "Me

Write for new descriptive Bulletin 17

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET • PHILADELPHIA 7, PE

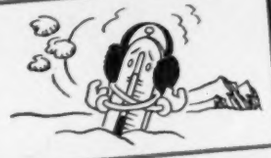
ONE OF A SERIES OF SUGGESTIONS TO AID PRODUC

Have You a Tough Grease Problem?

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

JUST LOOK AT SOME OF THE OPERATING CONDITIONS SPECIAL GARGOYLE GREASES ARE LICKING. THE EXPERIENCE THAT DEVELOPED THESE GREASES IS AVAILABLE TO YOU...

HIGH TEMPERATURE	**OVER 400° F.**		**Gargoyle Grease BRB4 Gargoyle Sovarex Grease**
EXCESSIVE WATER	**WATER-FLOODED BEARINGS**		**Gargoyle Grease AA Gargoyle Sovarex Grease**
EXTREME SPEEDS	**20,000 TO 50,000 R.P.M.**		**Gargoyle Grease BRB4 (for ball bearings)**
HIGH PRESSURES	**MEETS MOST SEVERE STEEL MILL USE**		**Gargoyle Grease Sovarex L**
LOW TEMPERATURE	**−40° F.**		**Gargoyle Mobilgrease Zero**
WIDE TEMPERATURE RANGE	**+250° F. TO −60° F.**		**[Name on Request]**

IF YOU are responsible for the operation of any machines or equipment that are grease-lubricated—*be sure you've heard the Gargoyle Grease story!*

There is available to you the same full line...the same high quality in Gargoyle *Greases* that you have learned to depend upon in Gargoyle *Oils.*

And they are sold on the same basis i.e. *their use will bring you benefits in power and maintenance economies...and in full time, capacity production!*

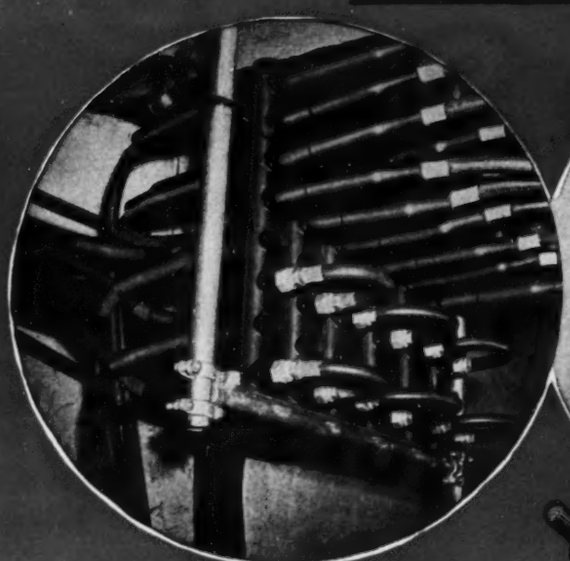
SOCONY-VACUUM OIL CO., INC.— Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corporation of California

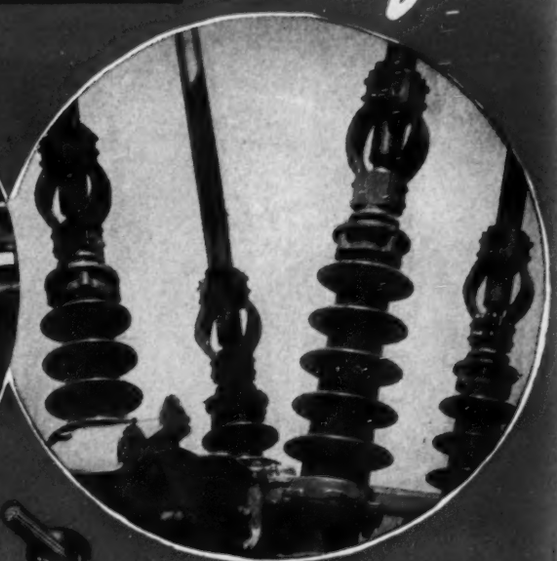
GARGOYLE **Lubricants**

HEADQUARTERS FOR GREASES TO MEET EVERY PROBLEM—

SOCONY-VACUUM

WE'VE KEPT THE FUNDAMENTAL JOB *in focus!*





BURNDY'S *leadership* in electrical connectors now covers the aviation, marine and all other war industries . . . thanks to years of pioneering with the utilities in the development of connectors for all utility requirements. But even under the pressure of turning out connectors *literally by the millions* for war needs, Burndy's thoughts and engineering planning have remained focused on the years ahead. For the backbone of the great electrical era coming will be the utility . . . and headquarters for utility connector requirements will remain here . . . at Burndy.

UTILITY Headquarters for connectors

BURNDY

ELECTRICAL CONNECTORS

OVERHEAD • UNDERGROUND • POWER • WIRING • GROUND

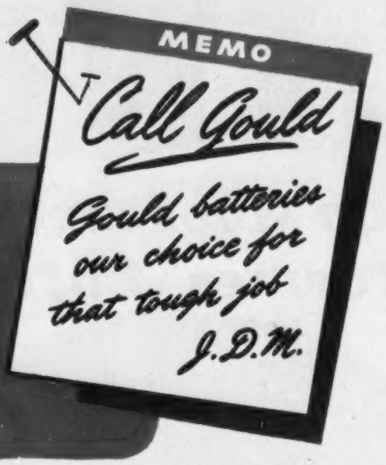
BURNDY ENGINEERING CO., INC. • 107 EASTERN BOULEVARD, NEW YORK 54, N.
IN CANADA: CANADIAN LINE MATERIALS, LTD., TORONTO 13, CANADA

ILLINOIS

High Tension Gooseneck Porcelains for Transformer Entrance Wires

• Accuracy in control of production of ILLINOIS Porcelain assures exact dimensions plus high mechanical and high dielectric strength for perfectly balanced insulators. All sizes and shapes are available for high tension transformers of every type—ease of installation assured because of uniformity —right fit means dependable service.

ILLINOIS ELECTRIC PORCELAIN CO., *Macomb, Illinois*



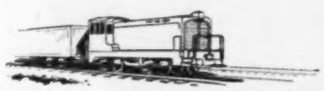
GOULD BATTERIES HAVE EARNED THEIR SERVICE STRIPES IN SERVING AMERICAN INDUSTRY

Back in the days when storage batteries were known as "accumulators" Gould began manufacturing batteries to meet specific needs. Today Gould batteries have earned their service stripes in every type of American industry.

The Koppers Coal Company of Grantown, W. Va., is but one of the many mining companies depending on Gould batteries to supply motive power to mine locomotives and shuttle cars.

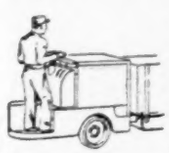
The Rochester Telephone Company of Rochester, N. Y., like many of the nations' telephone systems, uses Gould batteries to maintain a constant supply of current for their telephone operations.

Gould storage batteries are meeting the rigid standards of the United States government in delivering power for fire control on battleships, for the under-water propulsion of submarines and by our air forces for every battery application.

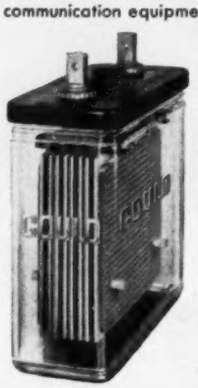


Among the many American railroad companies employing Gould batteries in Deisel switch engines and for other importont operations is the Chicago, Burlington & Quincy R. R.

The Pacific Gas and Electric Company and other major utilities employ Gould batteries in the control of millions of dollars worth of power and communication equipment.



In factories and warehouses of numerous manufacturers like the American Can Company, Gould batteries supply power for platform trucks, tractors, skid lift trucks, and any eletric vehicle used for materials handling.



SPECIFY GOULD PLANTE ... The battery with antimony free positives for control and standby applications.

Rated Conservatively ... Goulds equal or exceed in capacity any battery of comparable size and cell structure.

Gould Storage batteries are standing by in the Doctor's Hospital of Washington, D. C., and other leading hospitals to insure light and power in case of service failure.

GOULD STORAGE BATTERY CORPORATION, DEPEW, NEW YORK

Builders of industrial batteries for every application. Sales and service offices in principal cities of the U. S. A.

Factories at Depew, N. Y., North Bergen, N. J., Dallas, Atlanta, Chicago, St. Paul, Leavenworth, Los Angeles

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

PUT IT ON THE RECORD

One of a series of service suggestions for users of industrial batteries.

▶ Battery life can be greatly e tended when accurate records individual cell voltages, gravities a water consumption are continuou maintained. So important to b tery life is the compilation of co plete records, that Gould employ staff of service men, who are charg with the responsibility of helpi customers to install a service reco system to meet their needs.

Records are the eyes of batte service. For example, an individ cell in an industrial truck batte owned by a large battery u showed up on the record as havin voltage at variance with other c in the same battery. As time w on this difference became more a more pronounced, and a Gould s vice man was called in. Upon i spection, a cracked separator w uncovered as being the cause of t trouble, whereupon it was repla and the battery put back into ser within two hours.

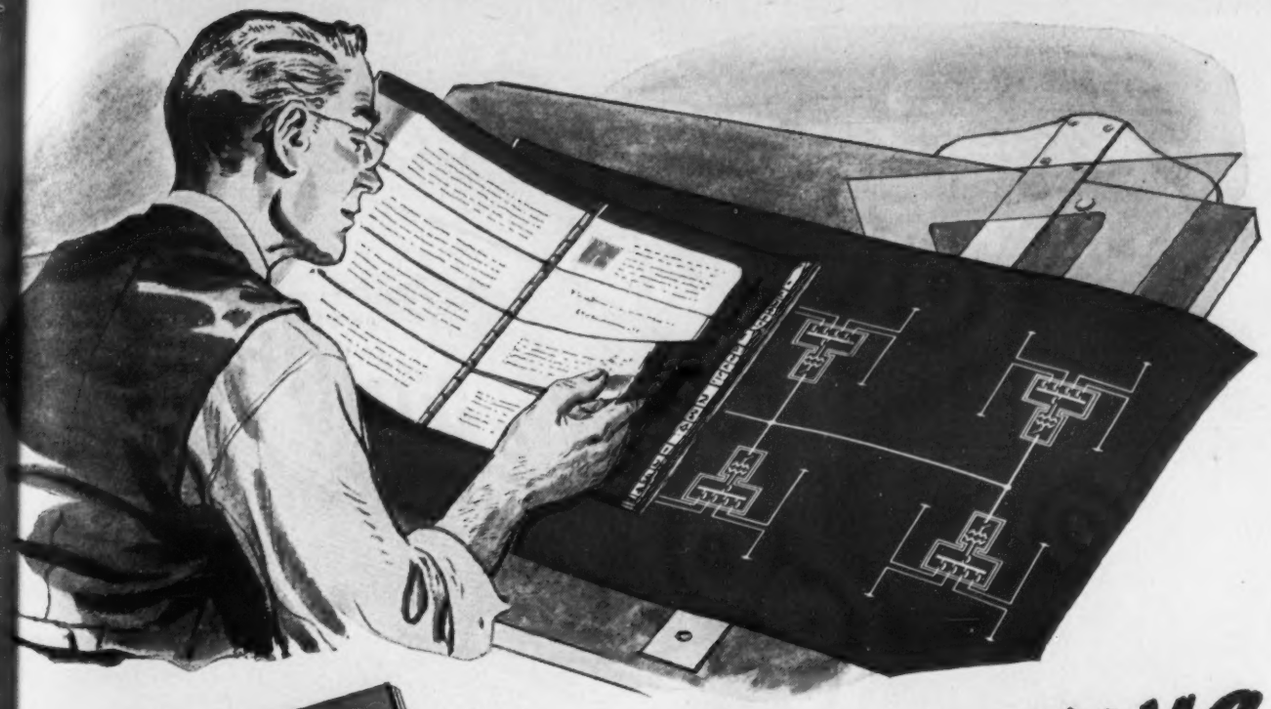
By contrast, where records w not kept, another case of a simi nature was not discovered unti routine Gould service call was ma The cell in this battery had b worked beyond the point of rever Sulphation had set in, and the e ment had to be replaced.

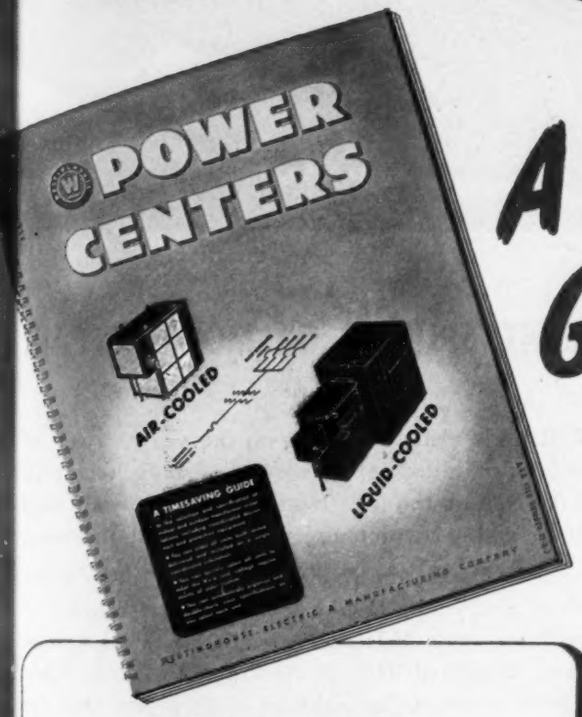
Here you have an example actual saving in man-hours a materials achieved through the u of an up-to-date battery service r ord system.

Modern record systems will alw lengthen life and improve operat efficiency. The control engin knows the importance of a rec system. Battery records are a p of his business. All floating batte in his charge may last 8 or 16 y depending upon a very slight v ance of cell voltage.

We would like you to know the G men who will take care of your indus storage battery requirements.

Serving the Upper Ohio River area are S Gane located in the Fifth & Grant Buil Pittsburgh, and E. J. Schneider, whose o is at 105 E. Third St., Room 202, Cincin Ohio. In this same area Gould is repres by E. J. Boyle of the E. J. Boyle Co., Fif Grant Building, Pittsburgh, Pa., and F Prather of the Rawlplug-Cincinnati Co., E. Third St. Cincinnati, Ohio. (Advertisem





A TIME-SAVING GUIDE in getting transformer equipment on the job *FASTER!*

Power Centers meet today's need for quick, convenient "packaged power" anywhere inside or outside the plant.

This handy selection guide enables you to order—and get—all units built, tested, delivered and installed as a single, co-ordinated substation just as you want it . . . ready to work. It shows clearly the choice of transformer, disconnect and protective arrangements that can be included in Power Centers for your type of distribution system. It enables you to specify quickly the correct units for your Kv-a and voltage needs. It automatically double-checks your specifications.

Write for your copy of this convenient selection guide today. Ask for B-3224. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

J-70421

SIMPLIFIES

- Selecting
- Specifying
- Ordering

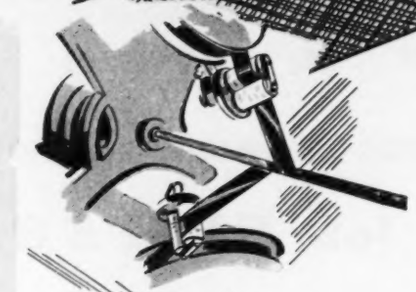
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

POWER CENTERS

Insulation Headquarters

IS BACK OF IT . . .



FOR EQUIPMENT, SPLICING OR MOTOR REPAIR

THE FAMILIAR trade mark, EMPIRE, on the end of a roll of varnished cambric, or glued to the core of a single tape roll, signals "OK" to the man on the job. It stands for a tape he's used before, or seen in use giving maximum service in many applications.

Every time you specify Empire for your equipment, or order it for splicing or motor repair, you're buying a share of the benefits of Mica's long experience — top dielectric strength, sure seal against damaging moisture, flexibility without cracking of varnish films, and maximum tensile strength. Straight-cut cambric and tape for smooth layers between field coils and end windings, slot and phase insulation, straight machine taping. Bias-cut, with just the right amount of stretch to give snug-fitting wrappings over irregular surfaces — coils, cable splices, bus bars and terminals.

Save time by ordering *all* your insulations from Insulation Headquarters.

Mica Insulator Company

200 Varick Street, New York, N. Y. • 600 Van Buren Street, Chicago, Ill.
501 Marion Bldg., Cleveland, Ohio • *Representatives in principal industrial centers*

100H UNIVERSAL MATTHEWS FUSE LINKS

COVERED BY PATENTS 1,797,850, 2,067,577 AND PATENTS PENDING

BEST FOR CASCADING

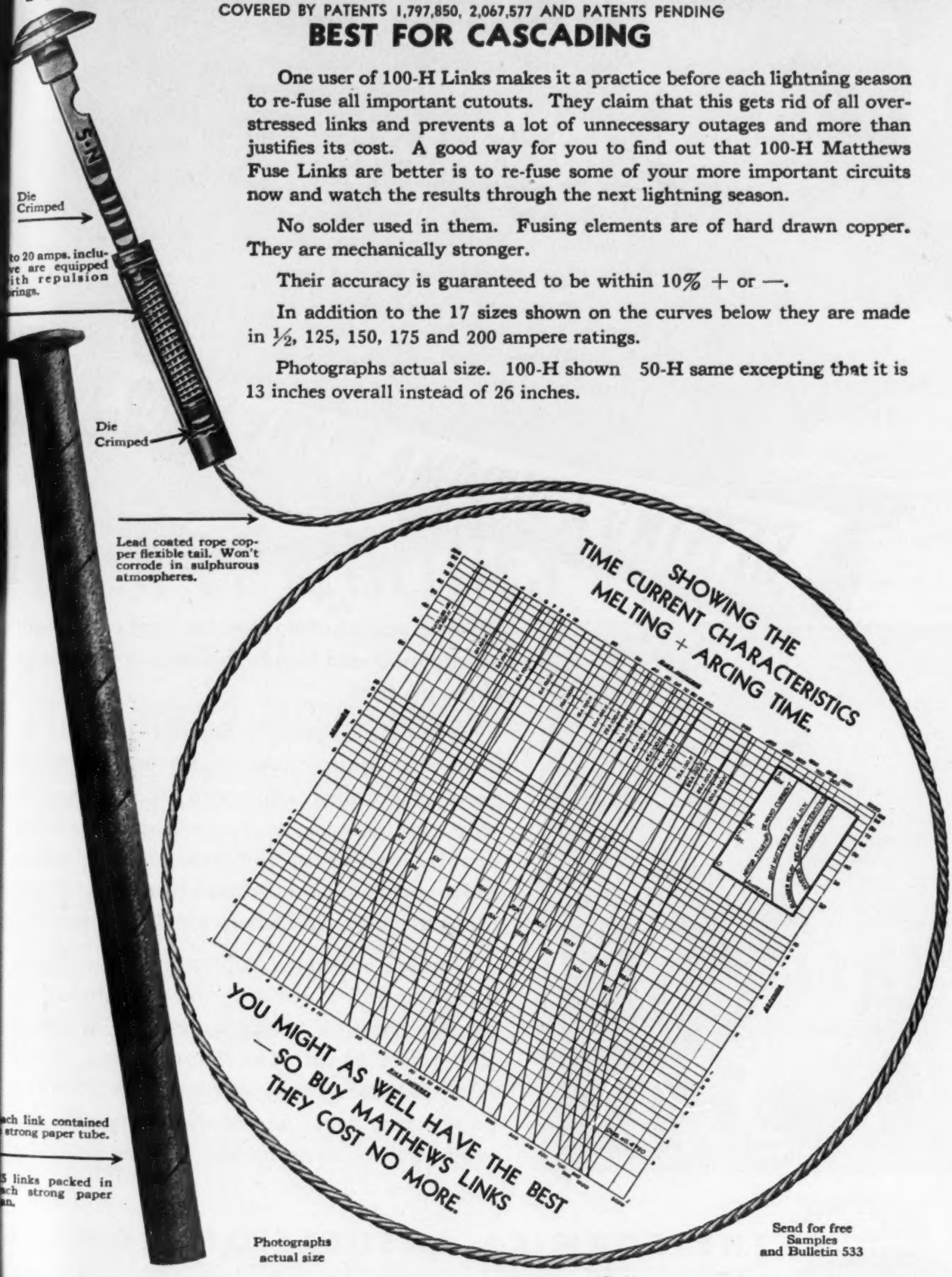
One user of 100-H Links makes it a practice before each lightning season to re-fuse all important cutouts. They claim that this gets rid of all overstressed links and prevents a lot of unnecessary outages and more than justifies its cost. A good way for you to find out that 100-H Matthews Fuse Links are better is to re-fuse some of your more important circuits now and watch the results through the next lightning season.

No solder used in them. Fusing elements are of hard drawn copper. They are mechanically stronger.

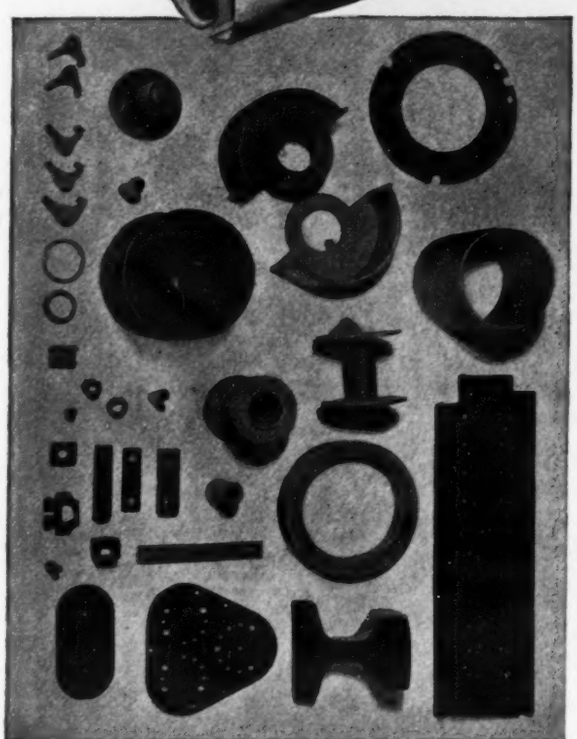
Their accuracy is guaranteed to be within 10% + or —.

In addition to the 17 sizes shown on the curves below they are made in ½, 125, 150, 175 and 200 ampere ratings.

Photographs actual size. 100-H shown 50-H same excepting that it is 13 inches overall instead of 26 inches.


Die Crimped
to 20 amps. inclu-ve are equipped ith repulsion rings.
Die Crimped
Lead coated rope copper flexible tail. Won't corrode in sulphurous atmospheres.
SHOWING THE TIME CURRENT CHARACTERISTICS MELTING + ARCING TIME.
YOU MIGHT AS WELL HAVE THE BEST —SO BUY MATTHEWS LINKS THEY COST NO MORE.
ach link contained strong paper tube.
5 links packed in ach strong paper an.
Photographs actual size
Send for free Samples and Bulletin 533

W. N. MATTHEWS CORPORATION, ST. LOUIS, U. S. A.



When a parachutist takes his final exam both his diploma and his life depend on the fitness of his rip cord.

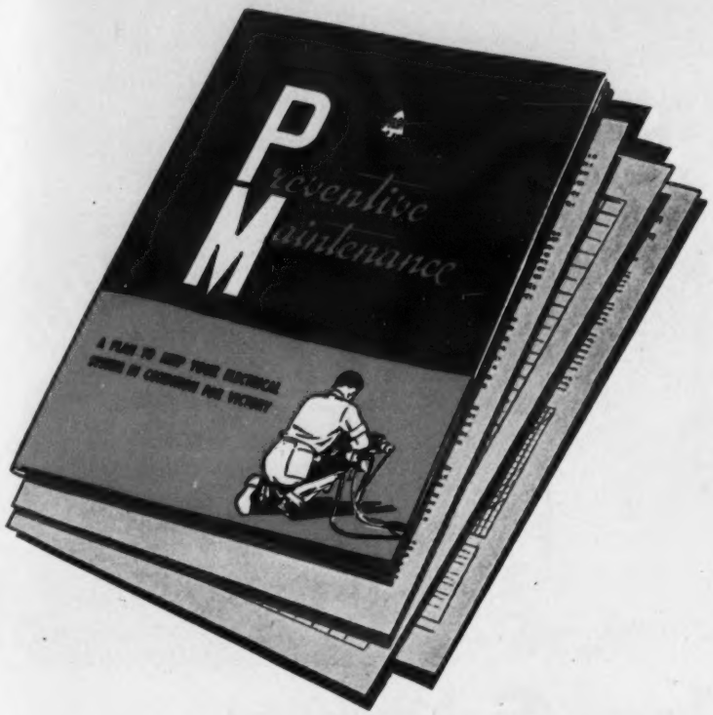
Lives also frequently depend upon the fitness of inconspicuous radio and electrical parts of Formica laminated plastic used in war equipment — such parts as insulating spools, insulating spacers, breaker arms, radio tube socket bases, terminal strips, rheostat cores and other insulating parts.

Formica combines lightness with strength, dimensional stability, and resistance to change through chemical action. It has a low power factor, low dielectric loss. There is a wide variety of grades each of which emphasizes some one of the many valuable properties of material for special purposes.

ARMY E NAVY
FORMICA

THE FORMICA INSULATION COMPAN

4630 SPRING GROVE AVENUE • CINCINNATI, OH



OVER 60 UTILITIES

are using the PM plan to spearhead service campaigns

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 60 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City 4

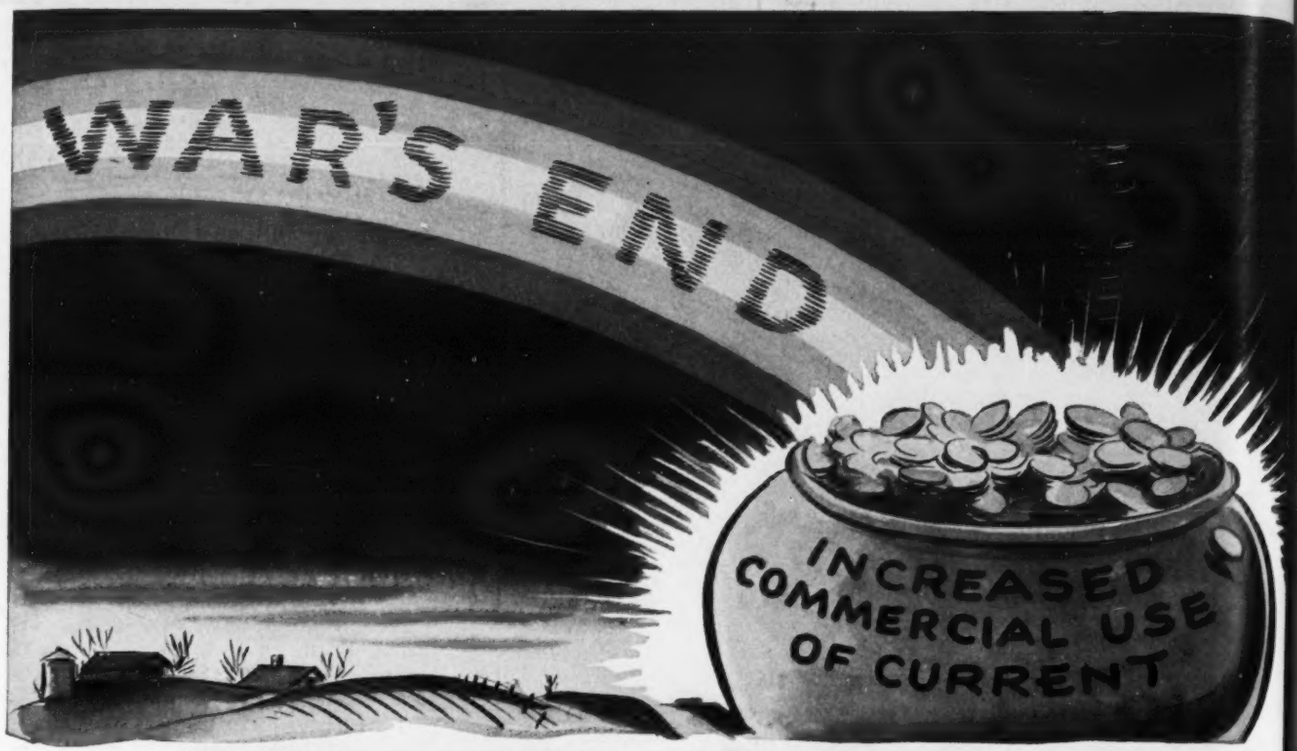
Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

11L



After the Storm...

Let's hit that jackpot!

WAR'S END will find some electric companies with peak loads for which there is not sufficient need . . . especially during the change-over period. Let's cushion the drop—let's build *even better*, more stable business for postwar days by tackling the problem now.

Increase Commercial Use

Notice how our advertising is telling hotels, restaurants, bakeries, hospitals and institutions the story of electric cooking *in their own trade publications.* It is preparing them to install Hotpoint-Edison Electric Cooking Equipment at first opportunity . . . just when the added load will be most welcome to *you.* Remember too, most cooking is done in off-peak period

Plan ahead. Now is the time to make a study o commercial cooking and baking in your market, find ing out what equipment will first need replacing.

Tell customers and prospects this new ruling: *"If your present equipment is inadequate or beyond re pair, consult your distributor or write Hotpoint. New government regulations now permit manufacture of a limited quantity of equipment for essential civilian use."*

Edison General Electric Appliance Co., Inc.
5618 West Taylor Street, Chicago 44, Ill.

For outstanding achievement in War Production

THE KITCHEN OF TOMORROW WILL BE ALL-ELECTRIC

Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT

RANGES • BAKE OVENS • ROASTING OVENS
DEEP FAT FRY KETTLES • BROILERS • GRIDDLES

OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS

HERE'S THE KIND OF OVERLOAD PROTECTION YOU NEED FOR PRODUCTION MACHINE MOTORS

THESE MONITOR FEATURES BACK UP THE PROMISE OF GREATER PROTECTION

1—Exclusive Monitor Compensated Overload Relay
Tests at +134.6°F and at —2°F show only a few seconds difference in tripping time. Full overload protection is assured regardless of surrounding temperature . . . hot, cold or fluctuating. The trip always will occur within the same time at a given percent of overload.

2—Vertical, Solenoid Principle
Introduced by Monitor in 1889—proved sound by over half a century of experience.

3—Double-Break Silver Contacts
Designed so that replacement can be made quickly and easily.

4—Easily-Interchangeable Coils
Change can be made for different voltages without disconnecting external wiring or removing starter from enclosure.

5—Tamper-Proof Protection
The reset button cannot be "blocked in" by operator.

6—Resilient, Shock-proof Mounting
Magnet frame and base are separated by a resilient material.

The Monitor

THERMALOAD V

SOLENOID STARTER

with COMPENSATED overload relay

Surrounding Temperature does not affect its Performance

The Monitor Thermaload V Solenoid Starter will provide the highest degree of overload protection for your valuable, almost irreplaceable motors. For, into its design have gone features bred of 55 years of experience in designing motor controls for industrial applications . . . features that help maintain high production rates . . . guard against intentional overload by thoughtless operators . . . protect your investment in equipment.

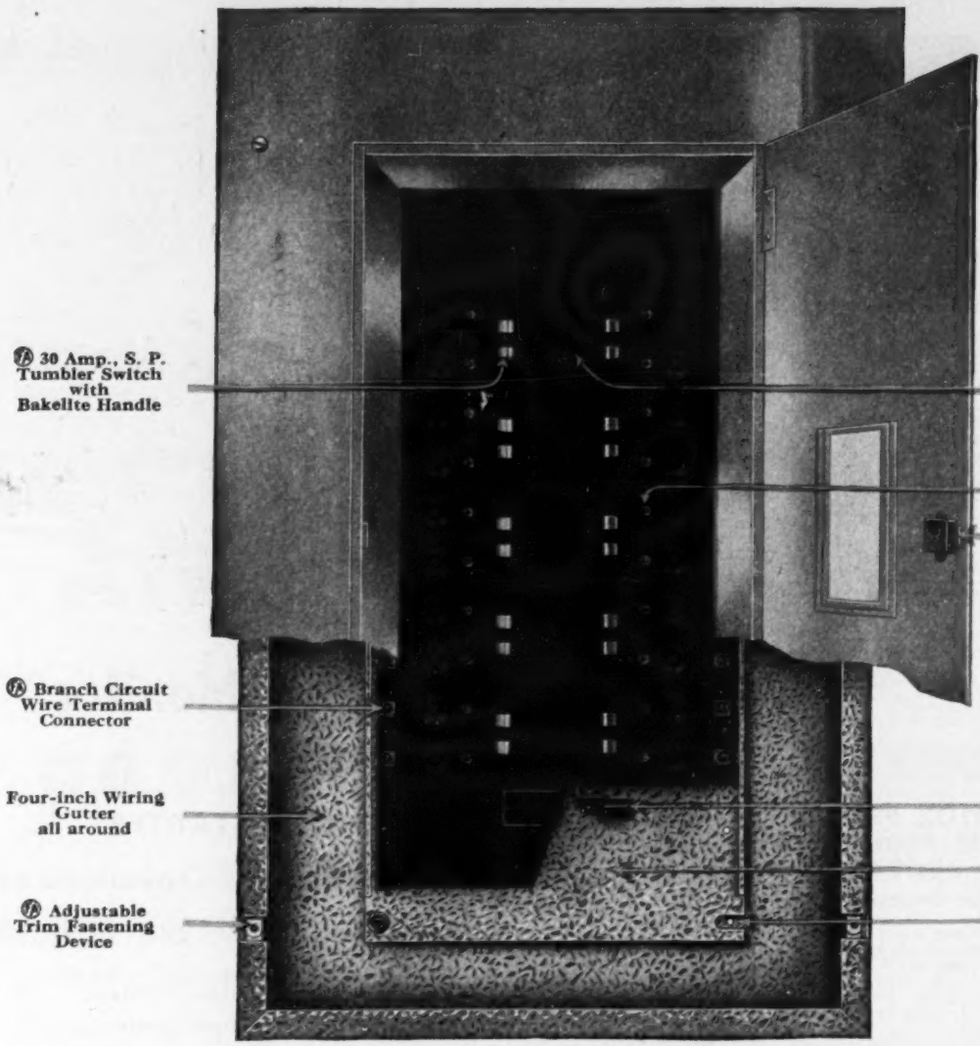
Specify the Monitor Thermaload V for original equipment or replacement. Available for 1.5 to 7.5 H.P., 110-550 Volts A.C. Motors. See the Monitor field engineer in your territory.

The Monitor Thermaload V Solenoid Starter can be shipped promptly from stock. Please comply with existing priority regulations when ordering.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE-2, MARYLAND

This (FA) Lighting and Appliance Panelboar is *safety type* under all operating condition


(FA) 30 Amp., S. P. Tumbler Switch with Bakelite Handle
One-piece Brown Bakelite Section
Circuit Numbering Tag
(FA) Catch Lock on doors 48 inches or less in heighth
(FA) Branch Circuit Wire Terminal Connector
Four-inch Wiring Gutter all around
Main Lugs under blank section
One-piece galvanized steel mounting back
(FA) Adjustable Trim Fastening Device
Four Mounting Slots instead of holes

This shows the rugged yet simple design of the (FA) 30 ampere Tumbler Switch used in (FA) LNT1P Panelboards.

Each section is of Bakelite, *molded in one piece.* There are no removable covers to fall off or become loosened by tampering . . . All parts, including the switches, are applied from the rear . . . The switch frames, main contact members to bus, and the required rivets to secure other parts, *are molded into the section* . . . Screw connections have been reduced to the minimum to assure uninterrupted service. The connection between the main bus bar and the branch circuit switches is accomplished by means of a new design clamp contact, which also contains the branch circuit switch contacts as an integral part. Direct copper-to-copper contact is thus secured without the use of screws or other accessories.

Each section contains four (FA) 30 ampere, single pole, heavy duty tumbler switches, with plug fuse connections . . . Branch Circuit tumbler switches are rated 30 amperes, 250 volts DC, and a of the quick-make, quick-break type, with doub break contacts.

(FA) Panelboards, for surface or flush mountin are available with from 4 to 42 branches; w main lugs only, or with safety type main fuse a connect, or (FA) Shutlbrak safety type main swit They are fully approved by Underwriters' La oratories, Inc.

Write for Bulletin 67

It contains complete descriptions, specificatio sizes, wiring diagrams, and prices . . . Fra Adam Electric Company, St. Louis, Mo.

EST. 1891 — THE SIGN OF A BETTER JOB
Frank Adam
ELECTRICAL PRODUCTS
for War Industry
FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

AMERTRAN HIGH VOLTAGE TEST SETS

test insulating materials easily, accurately!

(Below at right) Type No. TS 15: 5 KVA, 60 cycles, 220 volts input/ 0-50,000 volts secondary.

(Below) Type No. TS-1A: 5 KVA, single phase, 60 cycles, 220 v. input/ 12,500-25,000-50,000 output.

(Above) Type No. TS-1A: 25 KVA, single phase, 60 cycles, 208 v. input/ 25,000-50,000-100,000 v. output. Fully insulated.

(Left) Type No. TS-3: ½ KVA, single phase, 60 cycles, 115 v. input/ 0-1500 volts secondary.

THE capacity of AmerTran High Voltage Test Sets to test insulating materials insures economy and increased production for purchasers. Because of their versatility, one AmerTran Test Set may often replace three units of other types.

They are precise over a wide range of voltages yet capable of control in small increments. Through their simplicity, safety, ease of operation and calibration retention, they reduce observation errors.

The TS series, comprising stationary, mobile and portable units, covers a range of dielectric strength testing from transformers and cables to small apparatus, paints and fabrics. All sets function with laboratory accuracy.

Used by leading universities, utilities and industries, they represent the culmination of the skill and experience of the American Transformer Company, pioneer makers of dielectric strength testing apparatus since 1903.

AMERICAN TRANSFORMER COMPANY

178 EMMET STREET, NEWARK 5, NEW JERSEY

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

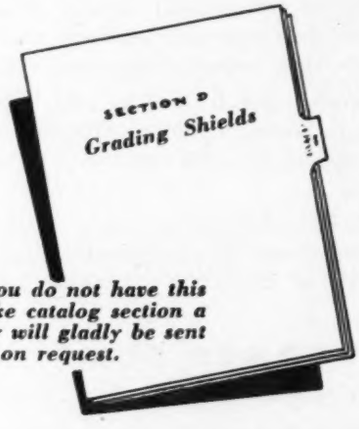
MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Hundreds of cases have been reported where, despite severe arc burns on the shields, insulators and conductors have not been touched.

Protect ... with Locke Grading

... Line flashovers are bad medicine for conductors and insulators ... particularly today when replacements are not readily available

Locke Grading Shields definitely minimize the possibility of flashover . . .



If you do not have this Locke catalog section a copy will gladly be sent you on request.

1 Due to improved voltage distribution and energy dissipation from the shields many flashovers are actually prevented.

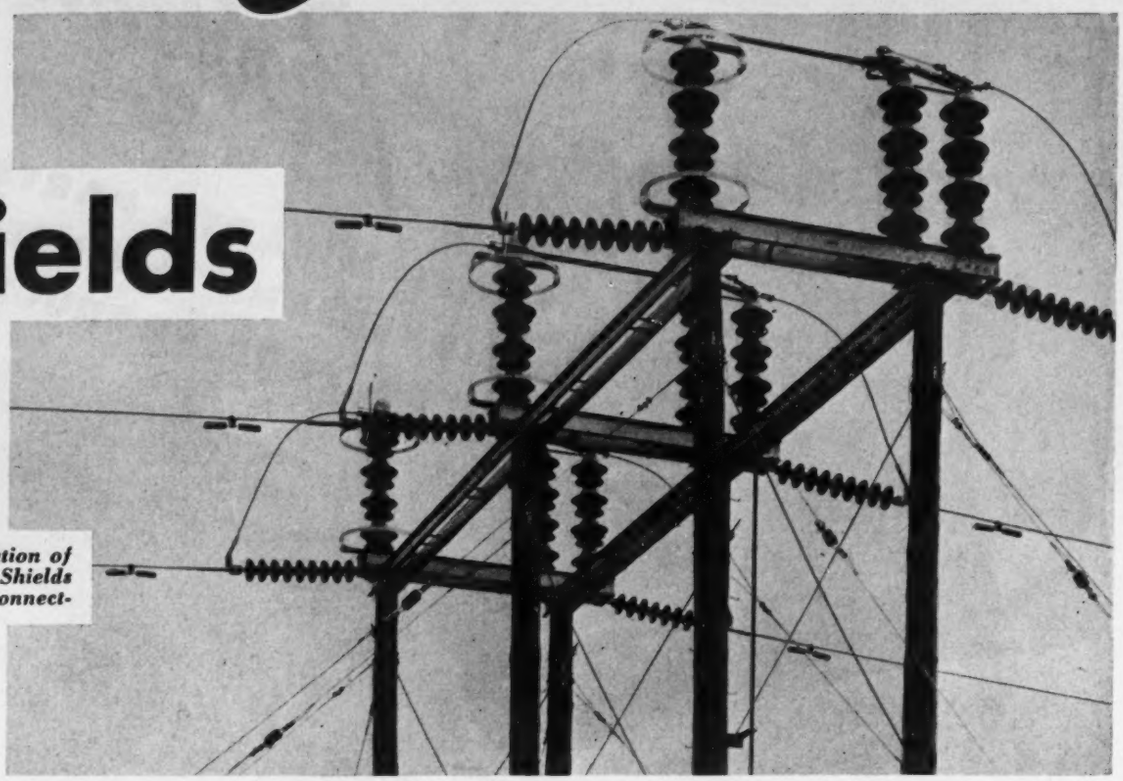
2 By inducing more uniform voltage distribution over the insulator string they stop "creeping" breakdown which may result from over voltage on the line unit.

3 Flashovers which do occur are controlled. Cascading is extremely rare when Locke Grading Shields are used. The arc forms between the shields and is kept away from both insulator and conductor.

LOCKE INSULATOR

Protect Your Conductors

with Locke Grading Shields



Typical installation of Locke Grading Shields on 161kv disconnecting switch.

. . . for switches and lightning arrestors, too . . .

Locke Grading Shields, by improving the voltage gradient over the stack, prevent corona formation.

They reduce the possibility of cascading under flashover with its attendant damage and expensive interruptions to service.

Set to gap the stack they safely limit the flashover values without reducing leakage distance.

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

LOCKE INSULATOR CORPORATION BALTIMORE MARYLAND

If your present manufacturing operations or postwar plans involve product parts where light weight is essential, consult Westinghouse.

Skilled Micarta engineers will be glad to study your product and to analyze its applications. And they will give you the benefit of 35 years' experience with industrial plastics.

This experience is particularly extensive with respect to aircraft applications . . . for example,

MICARTA IS THE IDEAL MATERIAL for airplane fairleads, guides and pulleys. Its weight is only one-half that of aluminum.

ON FIGHTERS AND BOMBERS, literally millions of Micarta parts are in constant use. Micarta is also used for control and instrument panels, antenna masts, terminal blocks, spacers and bearings . . .

AND IN MANY OTHER INDUSTRIES . . . hundreds of thousands of Micarta products are in use where light weight and dependability are vital.

In the majority of these applications Micarta is used as a replacement for critical material and is serving better.

We urge you to find out the facts about Micarta today. Wire or phone your nearest Westinghouse office or write to Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa., and ask for a copy of the new Micarta Data Book—B-3184. J-6839

TYPICAL MICARTA TOUGH JOBS IN WAR APPLICATIONS

Aircraft structural parts	Protective helmet liners
Industrial gears	Aircraft control pulleys
Instrument panels	Bus supports
Steel mill bearings	Fuse mountings
Thrust washers	Insulating washers
Marine bearings	

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Micarta

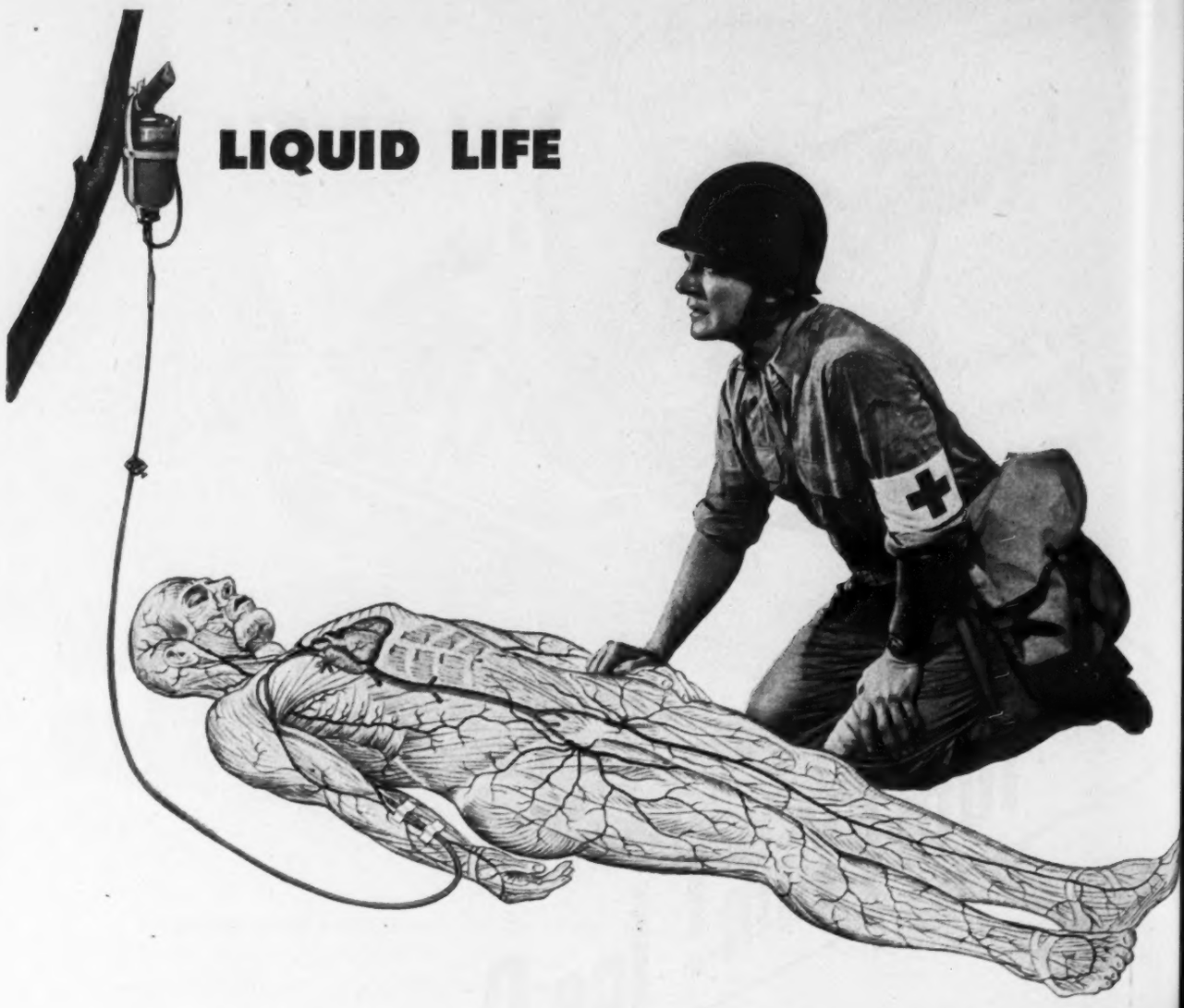
The INDUSTRIAL PLASTIC

Yum! Yum! Ice Cream!

A little boy who's full of ice cream is also full of sweet satisfaction. . . . And you, too, have a sense of satisfaction over the long years of service being given by the heating devices that are still plugged into your lines as good revenue producers. Most of them have Chromel elements, that last for years and years. Time was, before Chromel was discovered about 35 years ago, that heating devices were a nuisance because of their short lived elements. Then, too, before Chromel, you had no industrial heating-load, through resistor elements. . . . So, may we not say, that Chromel has for a long time been making a good contribution to your revenue? (Glad to send you Catalog-M. It gives useful information on Chromel.) Hoskins Manufacturing Company, Detroit 8, Michigan.

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

LIQUID LIFE



Not bullets, but *surgical shock*, has killed many a soldier in the wars of the past.

Shock is a breakdown of the blood circulatory system. Blood vessels contract. Circulation slows down, almost stops. If shock is too severe, death results.

Today, when a soldier is wounded, blood *plasma* is injected into his circulatory system. The plasma acts as a sort of pump primer . . . fills up the collapsed veins and arteries . . . starts the system working again. By thus counteracting shock, plasma saves lives and reduces suffering.

The whole blood you give at a Red Cross blood donor station goes through much processing before it gets to the front as plasma. At many points throughout the processing accurately-controlled *refrigeration* must be used.

To provide this refrigeration, General Electric has developed dependable refrigerating equipment that is more efficient, more compact and more flexible—to meet difficult war conditions.

This is only one of the many ways General Electric Refrigeration and Air Conditioning are helping to make a better world.

☆ BUY WAR BONDS ☆

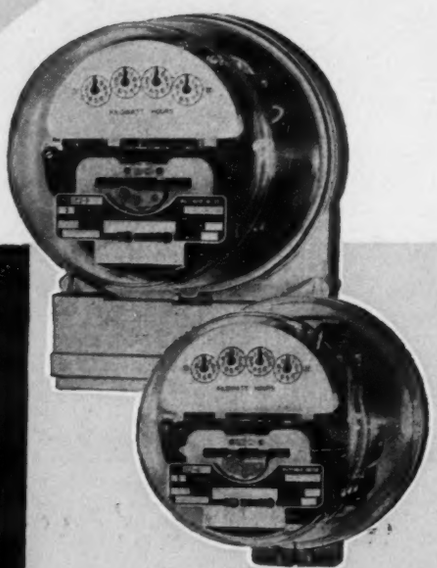
General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 4312, Bloomfield, New Jersey.

Industrial Refrigeration by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "HOUR OF CHARM," Sunday 10 P. M., E W T, N B C . . . "THE WORLD TODAY" News, Every Weekday 6:45 P. M., E W T, C

WAR BONDS MAKE
UNCLE SAM MORE
POWER-*full*



"On Measurement is founded the whole progress of man.."

If a lady from the Orient offered 75c a bushel and a lady from London countered with a bid of $1.00, the latter appears to be the obviously higher bid. But could this be wrong? The Oriental measure of the bushel is a shallow brass pan 18½" diameter and 8" deep. The lady from London may have in mind the London bushel (equals 2150.42 cubic inches) or the Winchester bushel (equals 2178 cubic inches). The disparity of the bushel is world-wide. Even here in the United States of America its measure varies in different states. No such disparity exists, however, in today's high standard of measurement set and met by the electric utilities and the manufacturers of watthour meters.

NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

● SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS ●

Although manpower shortages have greatly increased the demand for Hoosier service, we are still able to serve you promptly. For the Hoosier organization of trained men and special equipment has been built over a period of twenty-five years to meet just such emergencies. Today our service is immediately available to supplement your own organization on erection or maintenance jobs . . . regardless of distance or terrain.

HOOSIER ENGINEERING CO.

ERECTION and MAINTENANCE OF TRANSMISSION LIN

NEW YORK 46 S. FIFTH ST., COLUMBUS, OHIO CHICA

NO CONTACT MAINTENANCE • NO WASTED CONTACT MATERIAL
NO BEARINGS • NO PINS • NO PIVOTS • NO HINGES
NO COPPER CONTACTS • NO FLEXIBLE JUMPERS

SIMPLICITY

accounts for the ever-growing popularity of Allen-Bradley Solenoid Starters

STARTERS • PUSH BUTTON STATIONS • LIMIT SWITCHES • RELAYS • CONTACTORS

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

CHECK LIST OF INDUSTRIAL MOTOR CONTROLS

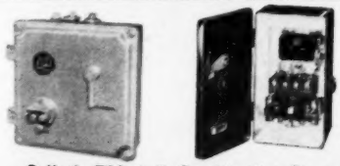
Bulletin 709 Starters in Five Sizes

3 Of the 9 Standard Enclosures

Bulletin 353 Small Drum Switches

Bulletin 375-385 Drum Switches

Bulletin 705 Reversing Switches

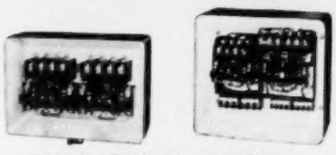


Bulletin 712 A-C Combination Starters

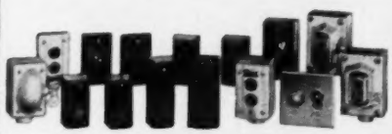
From the complete line of Allen-Bradley trouble-free motor controls, you can always find the right combination of standard units to meet any special industrial requirement. Our control engineers will gladly help you with your problems. Write for any bulletin listed below.

Allen-Bradley Company, 1316 S. Second St., Milwaukee, Wis.

Bulletin 700-200 Solenoid Contactors



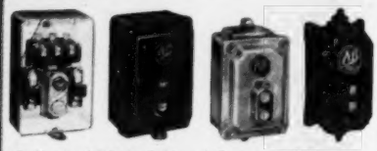
Bulletin 715 Multi-speed Starters



Bulletin 800 Push Buttons and Selectors

Bulletin 801-802 Limit Switches

Bulletin 640 and 740 Semi-Automatic and Automatic Resistance Starters



Bulletin 609 A-C Hand Operated Starters

Bulletin 600 Manual Starting Switches

Bulletin 836 Pressure and Temp. Controls

Bulletin 860 Solenoids

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

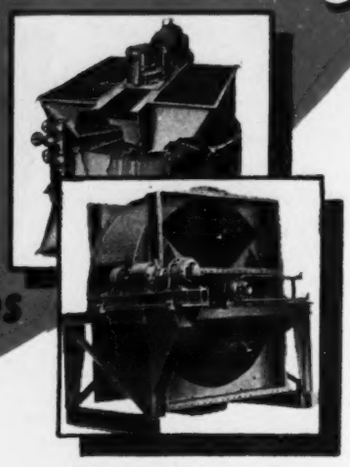
OIL INDUSTRY STEPS UP PRODUCTION OF 100-OCTANE AVIATION GAS

Washington, D. C.—Sept. 20—Production of aviation gasoline to meet the increasing pace of air warfare in both the European and Pacific areas

Behind headlines like this... "Ljungstroms" do double duty

1.. on refinery boiler plants

2.. on cracking still furnaces



Efficiency and fuel conservation in the production of 100-octane gasoline is being aided by use of Ljungstrom Air Preheaters at two critical points in refinery operation.

At one important new plant, four Preheaters are being included as a part of the steam generating unit. Here, they will raise the efficiency of steam generation, and permit efficient combustion of low-grade fuels.

Four other "Ljungstroms" will serve on cracking still furnaces. Gases from the furnace will enter the preheaters at 1450° F., and preheat the combustion air to over 1000° F. Their ability to handle these high-temperature gases makes possible an efficient furnace design using *less steel* in convection tube banks.

Further conservation of steel is secured in the Preheaters themselves, because of their unique *continuous regenerative counterflow* principle. Generally, a Ljungstrom weighs only ½ to ⅓ as much as alternate types for the same heat recovery, with additional savings in the supporting structure.

Repeat purchases by oil companies having over five years service experience with Ljungstrom Air Preheaters testifies as to the mechanical dependability of these units.

Our engineers are ready to work with you in applying the Ljungstrom to your own heat recovery problem.

For PRODUCTION ACHIEVEMENT...

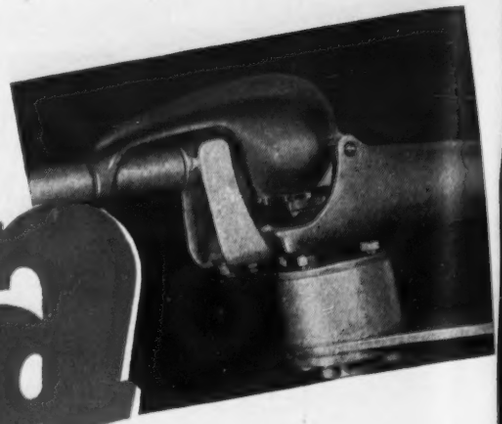
The U. S. Maritime Commission has awarded its "M" Pennant and Victory Fleet Flag to the men and women of Air Preheater Corporation.

THE AIR PREHEATER CORPORATION

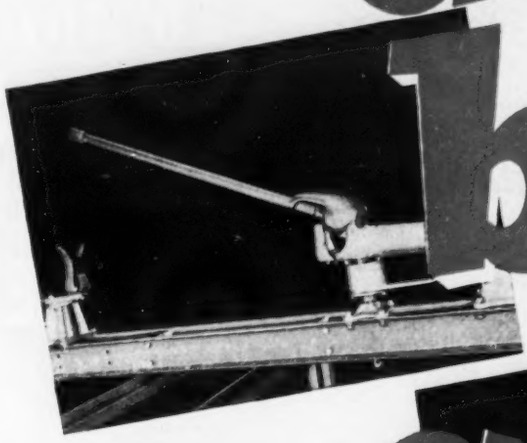
Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, New York

AS Simple AS a

Blade-actuating parts are completely enclosed... high-pressure contacts at both ends of blade... no shunts!



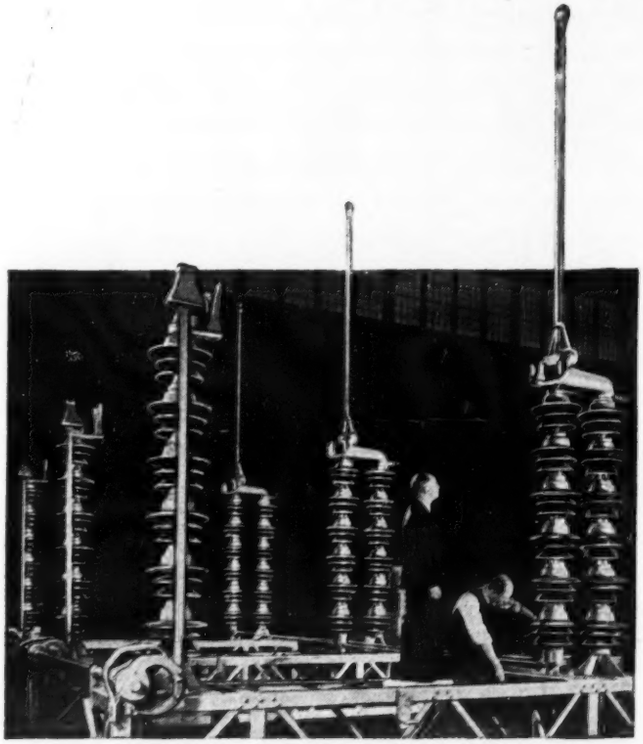
b



Blade rotation releases high-pressure contacts, leaving blade completely free *before* vertical movement. Counter-balance mechanism completely weather protected. Elimination of all sharp corners reduces corona.

c

Operates easily, even under ice conditions. Designed contours keep heavy ice from forming adjacent to moving parts. Cam-actuated blade twists readily, breaks ice that does form. Proved in 20-degree-below-zero cold room.



This type V outdoor group-operated disconnecting switch is available in ratings from 7.5 to 230 kv.

● THIS NEW HIGH-VOLTAGE OUTDOOR SWITCH HAS ONLY THREE MOVING LIVE PARTS PER POLE

When a high-voltage main-line disconnect switch needs to open — it's got to open! And operate freely and smoothly, regardless of weather conditions.

Note how this new Westinghouse outdoor disconnect switch is designed with utmost simplicity to meet these requirements. There are actually only three moving live parts per pole.

The group-operated switch illustrated at left occupies as much space as a small house. It is typical of the skill and "know-how" that Westinghouse brings to all central-station problems. For complete information on indoor or outdoor switch equipment for any application, write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

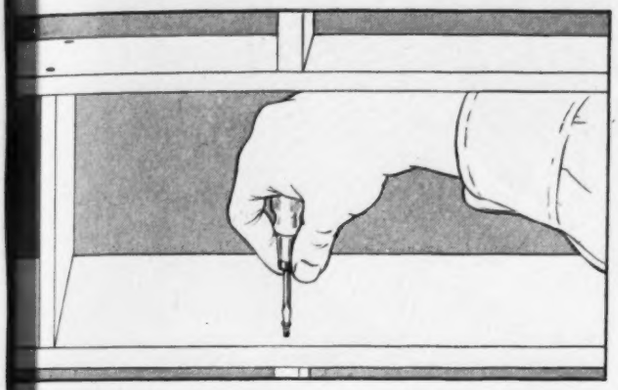
DISCONNECT SWITCHES

TOOL NOTES

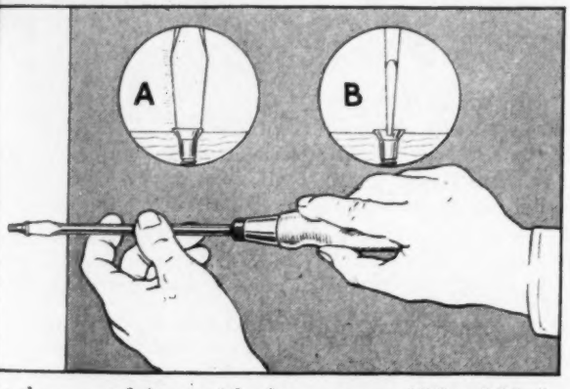
"How To Do It" Information For Crescent Tool Users

No. 16 . . . . PICKING THE PROPER TOOL FOR THE JOB

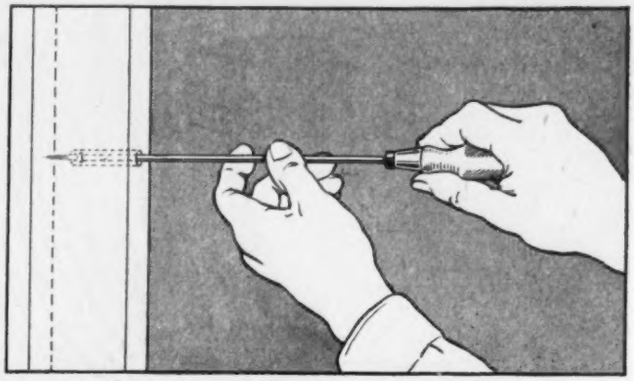
To the uninitiated, a screwdriver is just a screwdriver. But to the trained mechanic, the proper screwdriver for the job is *the* only screwdriver to use. Below are some examples:



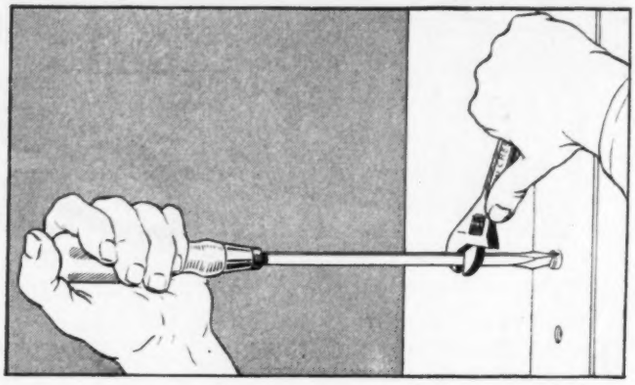
When working between obstructions, don't try to use a long screwdriver at an angle. Use a CRESCENT SHORT SCREWDRIVER. It will do the job better without marring the screw head and with less effort. Example: working between shelving.



Select the screwdriver with the proper width of blade to handle the particular size of screw being used. Inset A shows the correct blade width which is approximately the same as the screw head diameter. Inset B shows how the thickness of the blade should conform to the width of the screw head slot.



When inserting a screw in a deeply countersunk hole or electrical work where limited clearances will not admit a wide blade, use a CRESCENT ELECTRICIAN'S AND CABINET SCREWDRIVER, available in lengths varying from 6½" to 16½". Example: working in countersunk holes with short screws.



Where extra tightening pressure must be exerted, use a CRESCENT SQUARE ROD SCREWDRIVER in conjunction with a CRESCENT WRENCH as shown above. Example: tightening machine screws or oversize wood screws.

MAIL THE COUPON FOR FREE REPRINTS

This is No. 16, in Crescent's TOOL NOTES Series. These informative advertisements providing practical information for users of hand tools, are available either punched to fit a standard 3-ring binder or suitable for bulletin board and classroom use. Coupon request will receive prompt attention.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

Crescent Tool Co., Jamestown, N. Y. G-4
Please send your "TOOL NOTES" Series
☐ for Bulletins ☐ for 3-ring binder

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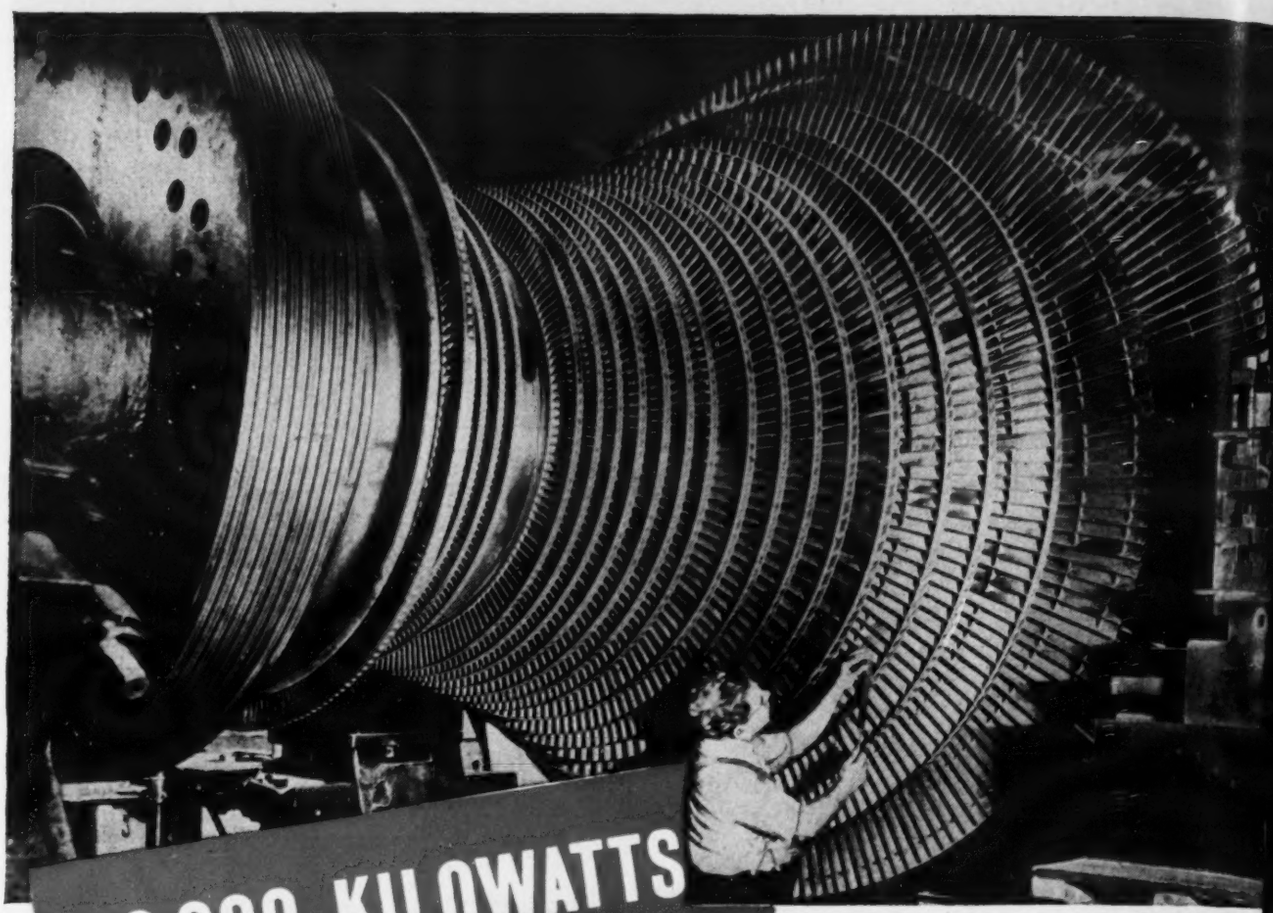


100,000 KILOWATTS *Coming up!*

BUILT TO harness a million pounds of steam an hour for producing 100,000 kw. of electrical power, this giant rotor of a 330-ton turbine is getting final inspection before shipment to help meet the Nation's ever-growing wartime demands for electric light and power.

Equally as important as the proper construction of turbo-generating equipment is proper maintenance, and prominent central station operators everywhere are assuring such maintenance of their steam turbines, by lubricating with *Texaco Regal Oil.*

Texaco Regal Oils assure normal bearing temperatures, governors instantly responsive to every load change. They keep turbine lubrication systems clean, rapidly free themselves from air and water, highly resist oxidation, gum formation, sludging. *They are rust and oxidation inhibited.*

So effective have Texaco lubricants proved that they are preferred in the various fields listed at the right.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXA

★*More stationary Diesel horsepower U. S. is lubricated with Texaco than wi other brand.*

★*More Diesel horsepower on stre trains in the U. S. is lubricated with T than with all other brands combined.*

★*More locomotives and railroad car U. S. are lubricated with Texaco tha any other brand.*

★*More revenue airline miles in the U. flown with Texaco than with any other*

★*More buses, more bus lines and mor miles are lubricated with Texaco with any other brand.*

TEXACO

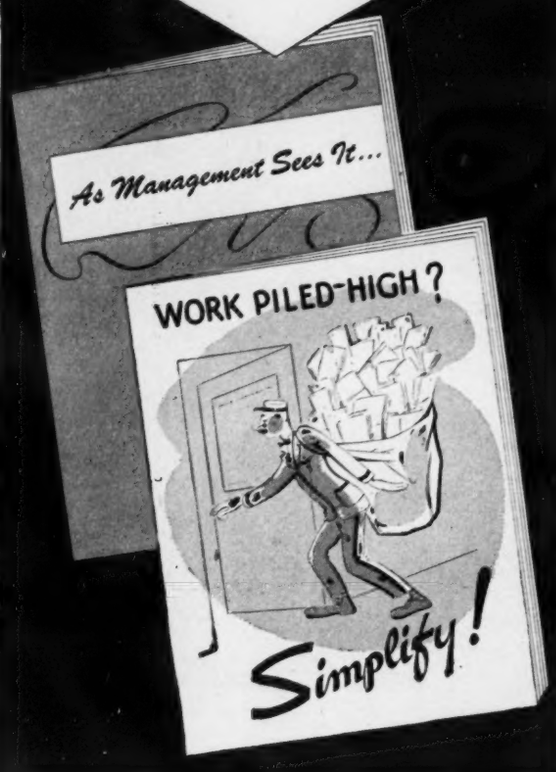
TEXACO Regal Oils

FOR ALL TURBINES

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PR

Solve your FILING PROBLEMS with a 3c stamp

Use it to send for these two eye-opening Booklets



Actually "hot off the press", these two books are full of *workable* ideas for you. They've been thoughtfully planned with one object in view: to place before you a comprehensive analysis of current filing problems and, what's more, *how to cure them!*

Your paper work is greater than ever... your records must be kept more available, and for longer periods... and, ten to one, you're as short of clerical help as the next fellow.

Before out-of-date and/or insufficient filing systems and supplies slow down your business operations to the point of costly inefficiency, fill out the coupon below, put it in an envelope addressed to Remington Rand, *then apply that 3¢ stamp* . . . and mail *today!*

REMINGTON RAND, Buffalo 3, New York.

Please send me *both* your books..."Work Piled High?" and "As Management Sees It". I understand I will be obligated in no manner.

Name.....

Position.....

Firm.....

Address.....

City..... State.....

REMINGTON RAND
BUFFALO 3, NEW YORK

A Light Weight, Heavy Duty Lever Switch Built to take the "Bumps"

● Terrific jar and vibration have little effect on the Mossman No. O-42 Heavy Duty Lever Switch. Once locked in place, its detent mechanism holds as securely as a vise.

Light in weight... but 4½ ounces with eight contact springs... the No. O-42 Lever Switch was especially designed for aircraft use. It affords 5 amperes control rating. Die cast frame may be either zinc or aluminum.

Contact assemblies of 8 springs per pile-up, 16 springs per position, or 32 springs total, have been successfully built into this switch.

Positive action detent mechanism consists of a stainless steel spring, which is located in a brass tube, inserted and staked in the tunnel of the switch frame. This spring exerts pressure against two free rolling, stainless steel balls. Pressure on the lever causes the outer ball to follow the contour of the latch plate, giving positive locking or spring return action. This pressure is independent of the pressure of the contact springs. Heavy contact spring pressure is unaffected by vibration.

Features of the Mossman No. O-42 Lever Switch include:

1. Standard heavy duty contacts are of 3/16" diameter fine silver for 5 amperes, 110 volts A.C. (non-inductive). Other contact materials are available to meet special conditions.

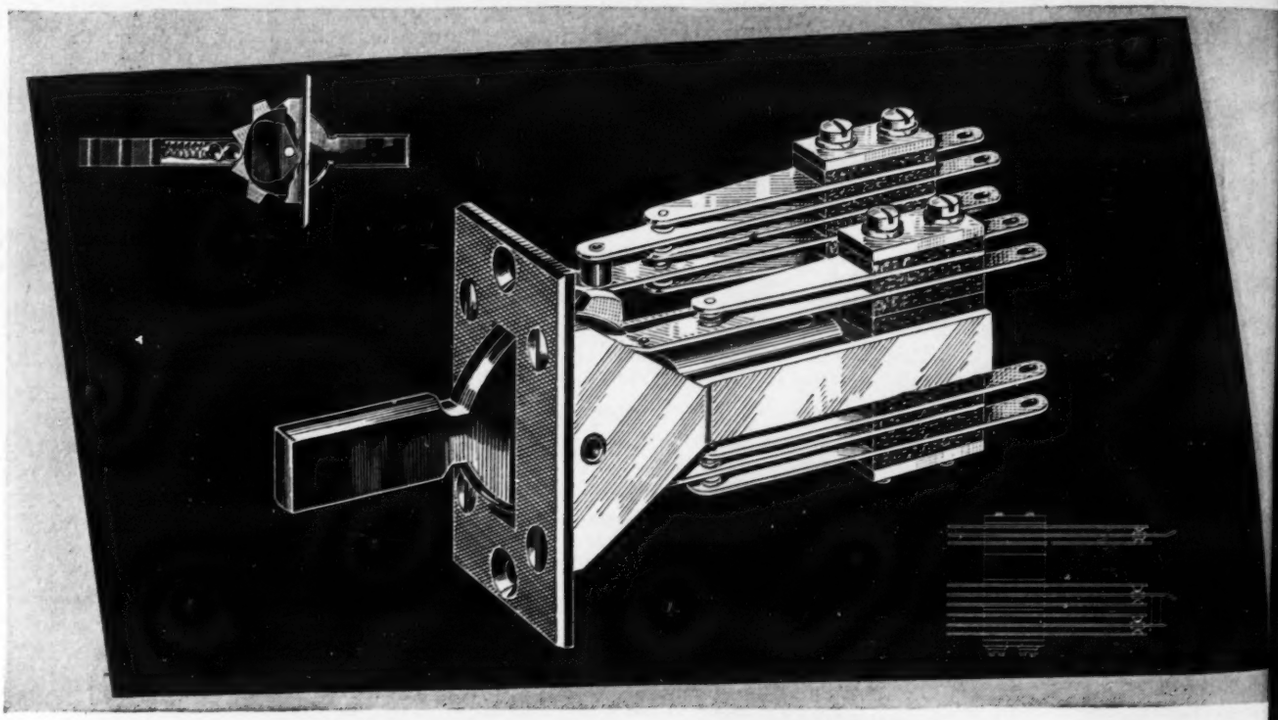
2. Contacts are spun into plated phosphor bronze springs. Ample wiping action of the heavy duty contacts insures clear contact surfaces, and provides rapid liberation of heat and resultant efficiency with longer life.

3. Spring contact pile-up insulators are Bakelite wafers assembled under pressure to insure against distortion. Edges are coated with Bakelite varnish. All insulation specifications conform to the highest standards.

4. Stops are set into the latch plate to effect locking, non-locking and no-throw positions. Lever action can be supplied with change from two-position to three-position; also from locking to non-locking, and vice versa.

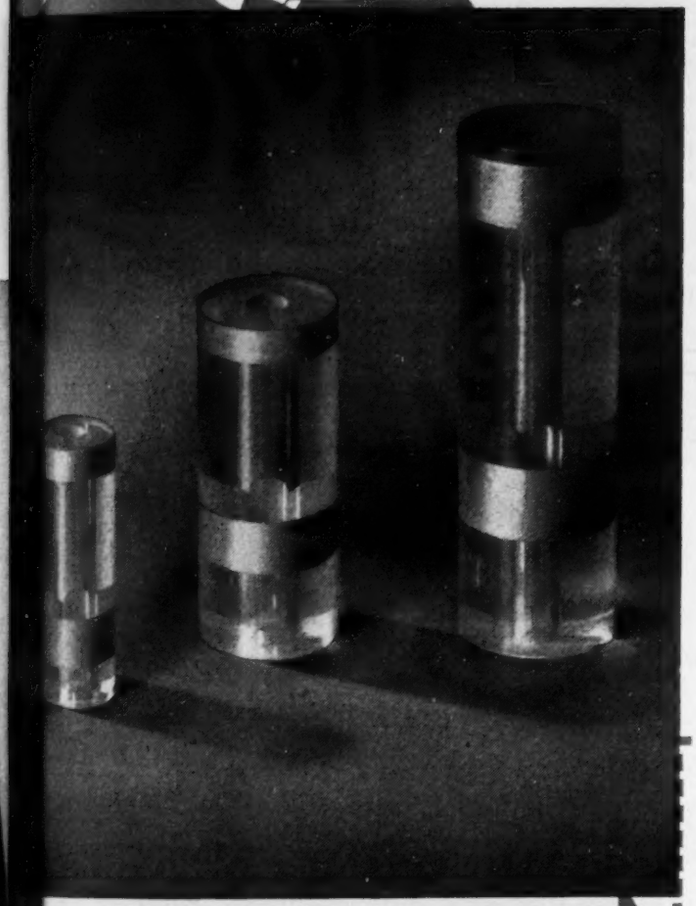
This Mossman No. O-42 Lever Switch is one of a line of precision electric components which includes many types of heavy duty multiple circuit lever switches, turn switches, push switches, plug jacks and special switching components.

Donald P. Mossman, Inc., 6133 N. Northwest Highway, Chicago, (31) Illinois



MOSSMAN *Electrical Components*

PUZZLE... CAN YOU FIND ALL EIGHT ADVANTAGES IN ANY OTHER BUSHING?



SEE WHAT YOU GET WITH NEW PYREX METALLIZED BUSHINGS:

1. **Permanent hermetic bond** — positive seal against leakage of oil, water, and air—no gaskets, washers, or "dopes" to leak.
2. **Quicker, less expensive assembly** — fewer parts and fewer operations reduce labor costs and speed up production—several can be soldered at once—no baking required.
3. **Practically foolproof** — the metallized layer solders easily. You can use any common solder and flux, applied by soldering iron, soft air-gas flame or induction heating.
4. **Great thermal shock resistance**—will easily meet Army and Navy specifications for rapid temperature change.
5. **Superior electrical characteristics of glass** —low dielectric constant, low power factor, high dielectric strength, and great electrical resistivity.
6. **Negligible water absorption** — no glaze to crack or chip.
7. **Does not carbonize or track**—because it's inorganic.
8. **A wide selection in several standard sizes.**

AIL COUPON for complete story

Corning Glass Works
Insulation Division, Department, W-11-1
Corning, N. Y.

Please send me full details of improved method of metallizing on glass.

Name.....

Company.....

Street.....

City.....*State*.....

Pyrex Insulators
BRAND

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.

Gulfcrest Oil *is stripped for action*

against sludge and oxidation in your turbines —

Alchlor Process refining more effe tively removes chemically activ hydrocarbons and other impuritie than other commercial methods

The performance records of Gulfcrest Oil in turbine systems of many of the leading power plants in the country are unmatched. Here's the important reason why:

Gulfcrest Oil is not only refined by conventional methods, but is super-refined by the Gulf Alchlor Process, the most thorough and effective method for creating the finest oils for turbine lubrication.

Developed 15 years ago, Gulfcrest Oil has become the leading turbine oil of the country.

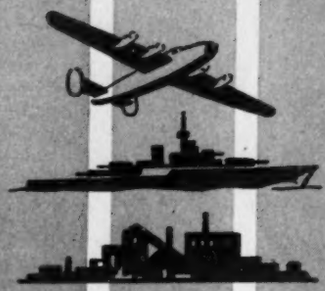
Ask the Gulf Lubrication Service Engineer in your vicinity to give you the facts on the performance and characteristics of Gulfcrest—he will show you how they can be translated into important maintenance economies in your plant.

GULF INDUSTRIAL LUBRICATION

FOR VICTORY —
BUY UNITED STATES WAR BONDS AND STAMPS

GULF OIL CORPORATION · GULF REFINING COMPA
Gulf Building, Pittsburgh, Pa.

A war Hero to Consider in Your Plans for the Future



In a bomber over Berlin . . .

aboard a battleship in the far Pacific . . .

on the production lines of American factories . . .

AT EVERY WAR FRONT ELECTRONICS IS PLAYING A HEROIC ROLE

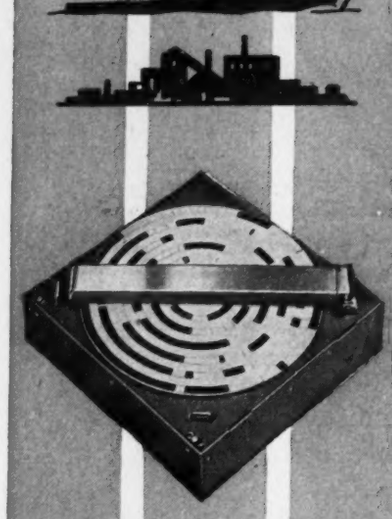
● There are hundreds of peacetime production jobs waiting for this war hero . . . jobs that Electronics can do better, faster, more economically.

In many ways which cannot now be told, General Electronics Industries has been helping to establish the great war record of Electronics through cooperative research with industrial organizations and Army and Navy research agencies. Our research engineers, skilled and experienced in advanced uses of Electronics, Hydraulics and Electromechanics, can give you valuable assistance in your production planning.

Remember: Today's plans mean tomorrow's profits. Write to Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Conn.

●

ELECTRONIC CONTROLS • VACUUM TUBES • HYDRAULIC SERVOS COMMERCIAL RADIO EQUIPMENT • ELECTROMECHANICAL DEVICES • ELECTROSTATIC HEATING UNITS UP TO 250 KW.



AUTOMATIC PROCESS CONTROL

For control of industrial processes from printed charts. Provides automatic control of chemical processes, also of production machinery.

Other products manufactured include:

ARMY-NAVY "E" WITH STAR awarded to Auto-Ordnance Corporation for continued excellence in production of "Tommy" Guns.

GENERAL Electronics INDUSTRIES

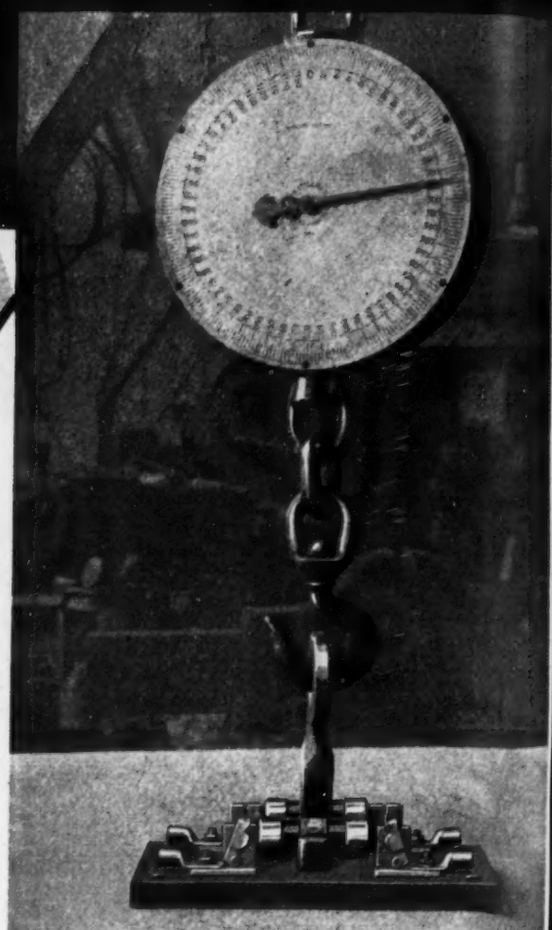
Division of Auto-Ordnance Corporation

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD • NEW YORK

"LOCTITE" FUSE WEDGE

Solves the Fuse-Pressure Problem

OVER 300 LBS. PULL BEFORE FUSE EVEN STARTS TO MOVE!

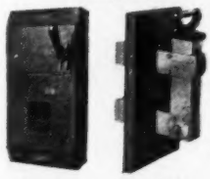


THE "Loctite" Fuse Wedge took a pull of 328 pounds before it started to move; the other fuse receptacle, 57 pounds (type "A" construction, too).

EC&M Switches of large amperage capacity—both Type "A" Safety Switches, and Type "A" Knife Switches—have this LOCTITE Fuse Wedge. It can't be lost—has no threads to strip—nothing to fall down across "hot" leads or terminals—is always available and easy to lock in position.

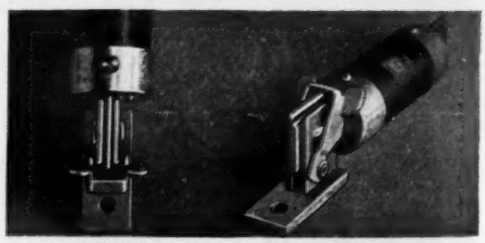
The heavy fuse-pressure prevents wattage loss—eliminates corrosion, discoloration, deterioration and heating which cause unnecessary blowing of fuses—combats vibration which lessens pressure and allows fuses to creep out.

Smaller sizes of EC&M Switches have fuse receptacles equipped with similarly efficient devices to insure high fuse-pressure. Ask for Bulletin 1300 for complete details on Safety Switches, Bulletin 1320 on Knife Switches.



SAFETY SWITCH

KNIFE SWITCH



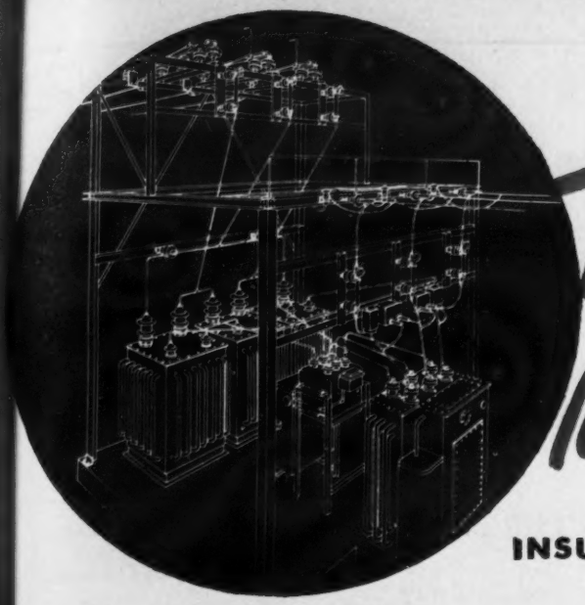
OPEN CLOSED

E&M

THE ELECTRIC CONTROLLER & MFG. CO.

2700 E. 79th St. Cleveland 4, Ohio

★



To reduce outages.. localize breakdowns

SPECIFY WESTINGHOUSE APPARATUS

INSULATORS FOR THE ENTIRE SUBSTATION

FROM 7½KV TO 287KV WESTINGHOUSE APPARATUS INSULATORS MEET EEI AND NEMA BASIC INSULATION LEVEL STANDARDS

Today's substation installations have an important job to do. There's no time for service outages because of unexpected insulator failure.

That's why we say, "Specify Westinghouse B.I.L. Standard Apparatus Insulators."

- The line is *complete,* ranging all the way from 7½ kv to 287 kv capacity.
- Each insulator conforms to EEI and NEMA "Basic Insulation Level" standards.
- Each insulator can be depended upon to provide a predetermined basic insulation level.

With these advantages, you can co-ordinate your entire substation at the correct insulation level. You can design your system to reduce outages, and—if electrical breakdown from lightning occurs—localize it at a point where the least damage will result to apparatus and service.

Next time you order outdoor apparatus insulators, specify Westinghouse porcelain. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. Factories at Derry, Pa., and Emeryville, Calif. J-05137

69 kv Insulator

Withstand Impulse Voltage: 350 kv with 1½ x 40 microsecond positive wave.
Dry Voltage: 175 kv, 60 cycle, 1 minute withstand.
Wet Voltage: 145 kv, 60 cycle, 10 second withstand.
Radio Noise Influence Voltage: 200 microvolts at 44 kv test voltage to ground.

46 kv Insulator

Withstand Impulse Voltage: 250 kv with 1½ x 40 microsecond positive wave.
Dry Voltage: 120 kv, 60 cycle, 1 minute withstand.
Wet Voltage: 100 kv, 60 cycle, 10 second withstand.
Radio Noise Influence Voltage: 200 microvolts at 30 kv test voltage to ground.

PLUS R.I.P. at no extra cost

R.I.P. stands for Radio-Interference-Proof—the simple permanent answer to all problems of insulator-generated radio noise. All Westinghouse Outdoor Switch and Bus Insulators, including the new units, are Radio-Interference-Proof.

7½ kv Insulator

Withstand Impulse Voltage: 95 kv with 1½ x 40 microsecond positive wave.
Dry Voltage: 35 kv, 60 cycle, 1 minute withstand.
Wet Voltage: 30 kv, 60 cycle, 10 second withstand.
Radio Noise Influence Voltage: 30 microvolts at 5 kv test voltage to ground.

Westinghouse PORCELAIN

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Gates — Intake, Sluiceway and Spillway

Hydraulic Turbines — Francis and Propeller Types

Rack Rakes • Trash Racks

Valves — Pipe Line and Penstock

★

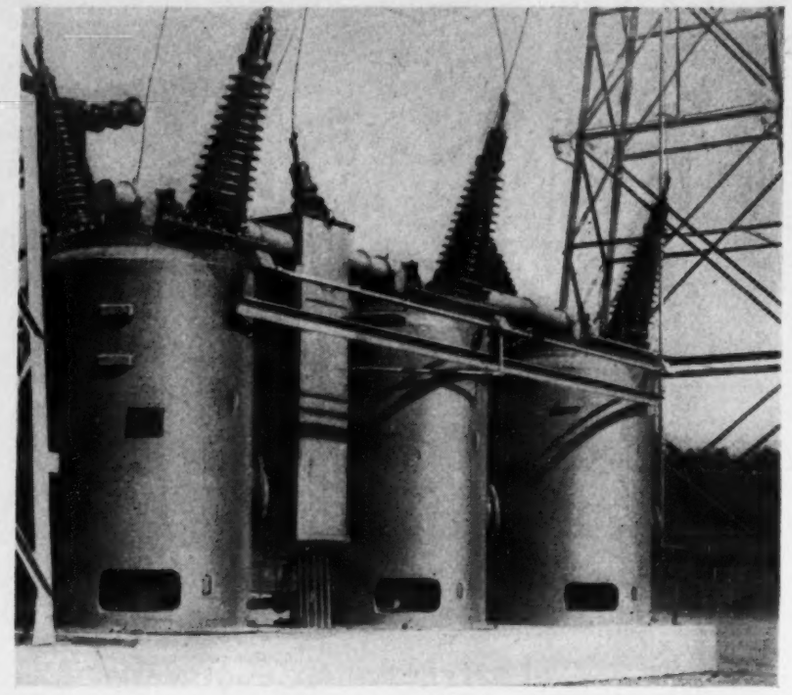
NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

NEWPORT NEWS, VIRGINIA

Why are PACIFIC ELECTRIC BREAKERS so *Reliable*?

You

GET THIS FAST ARC EXTINGUISHMENT WHICH PERMITS FAST OPERATION OF MOTOR MECHANISM AND QUICK FAULT CLEARANCE



Type RWE-78, 161-kv., 1200-amps., MH-4 Motor Mechanism; installation in Arkansas

Reliability in an oil circuit breaker is a result of *good design* with each part built to withstand loads far beyond normal. That assures a greater number of fault clearances at low maintenance costs. Here's a few reasons why Pacific Electric Breakers stand out in reliability:

Expulsion Chambers extinguish arcs quickly, save on contacts, save oil deterioration and reduce tank pressures.

Fast Motor Mechanism for breaker operation is possible because of fast arc extinguishment and you have fast fault clearance. The Motor Mechanism eliminates expensive station batteries, heavy cables, short-life rectifiers and air compressors. It operates from a strong spring, automatically motor-wound from low AC or DC current, providing *stored* energy for fast interruptions and fast reclosures. You get manual operation of the same constant operating speed which offers perfect synchronizing.

At scores of installations the nation over it has been proved that these Pacific Electric features, their great mechanical strength, perfect alignment, accurate blade motion from the Bevel-Link Drive—and More—are your assurances of safe reliability and long trouble-free protection from faults.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

Filbert & Fredericks
90 West St.
New York, 6, N. Y.

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Calif.

R. Ackerman
318 Dooly Block
Salt Lake City, 1, Utah

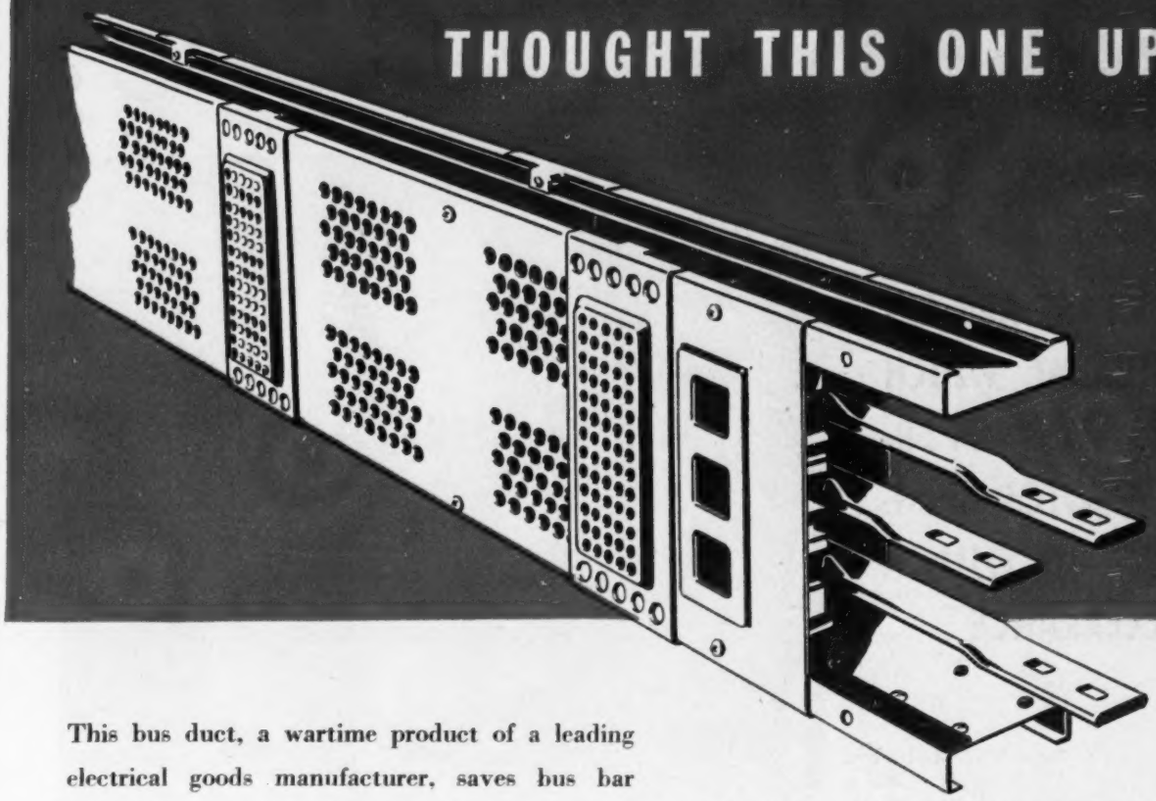
F. W. Gorman
P. O. Box 223
El Paso, Texas

Other representatives in principal cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

A WARTIME IMAGINEER THOUGHT THIS ONE UP



This bus duct, a wartime product of a leading electrical goods manufacturer, saves bus bar material by permitting heat to be dissipated faster; smaller bus cross sections can be employed for equal ratings. And it saves on the housing material by using perforated metal instead of solid sheet.

This is an excellent example of what we mean by *Imagineering*. Some engineer departed from standard channels of thinking, and produced a "substitute" which may have its effect on future construction.

Now, when postwar designers say, "Make both the bus bar and the housing of Alcoa Aluminum," that will be plain, good *Engineering*. The weight savings effected by building with aluminum means less burden to be carried by supports. Aluminum bus bars have ample current-carrying capacity and aluminum housings provide additional electrical advantages.

Prewar power lines of A.C.S.R., Alcoa Aluminum bus bars and housings, are serving thousands of war industries—visible evidence that it pays to Imagineer with aluminum. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Bldg., Pittsburgh, Penna.

IMAGINEERING AT WORK

ALCOA A·C·S·R

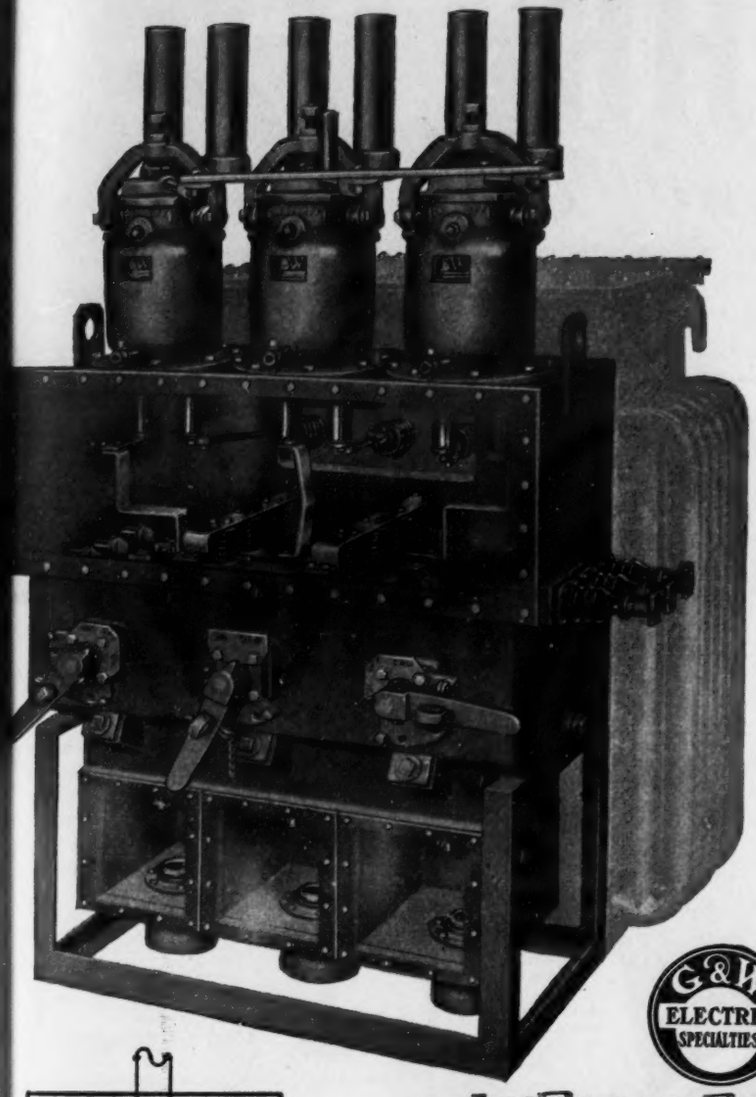
ALUMINUM CABLE STEEL REINFORCED

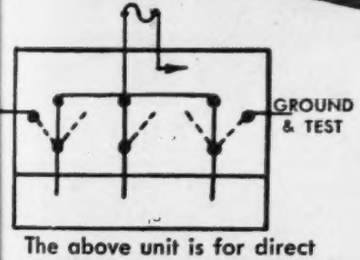
Combine G & W Type "RA" Oil Switches

WITH G & W TYPE "FC" OIL FUSE CUTOUTS *and other equipment*

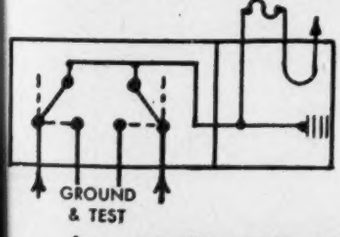
— SAVE INSTALLATION LABOR — SAVE SPACE — DECREASE INTERCONNECTING CABLE WORK

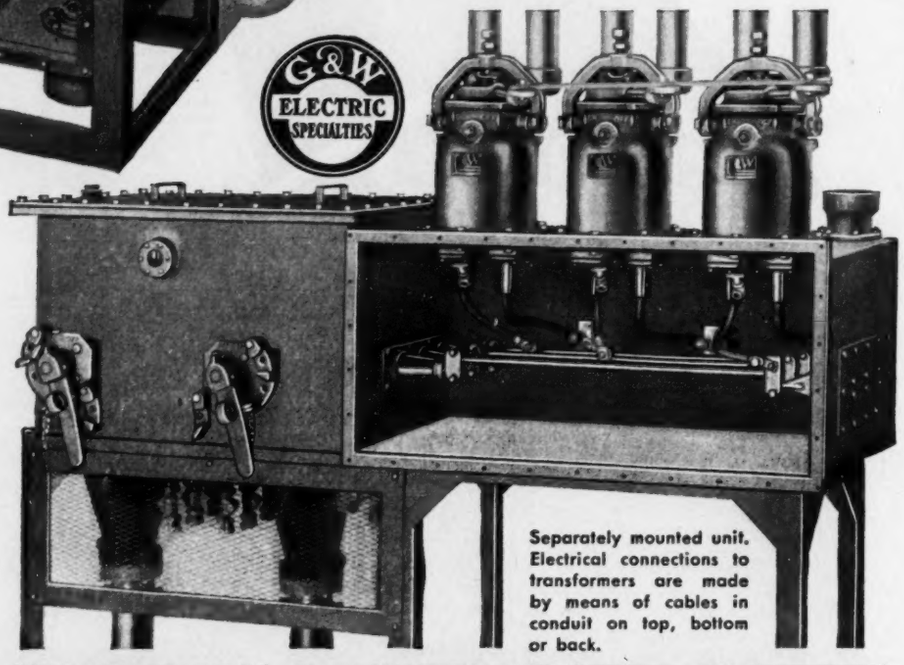
Here is real forethought . . . planning in advance for easier installation of equipment to fit into a smaller space. Also to provide for safe, economical and trouble-free distribution system flexibility . . . Simplify transformer substations by using G & W TYPE "MSF" combination metal enclosed units for switching and fusing.





The above unit is for direct attachment to transformer.





Separately mounted unit. Electrical connections to transformers are made by means of cables in conduit on top, bottom or back.

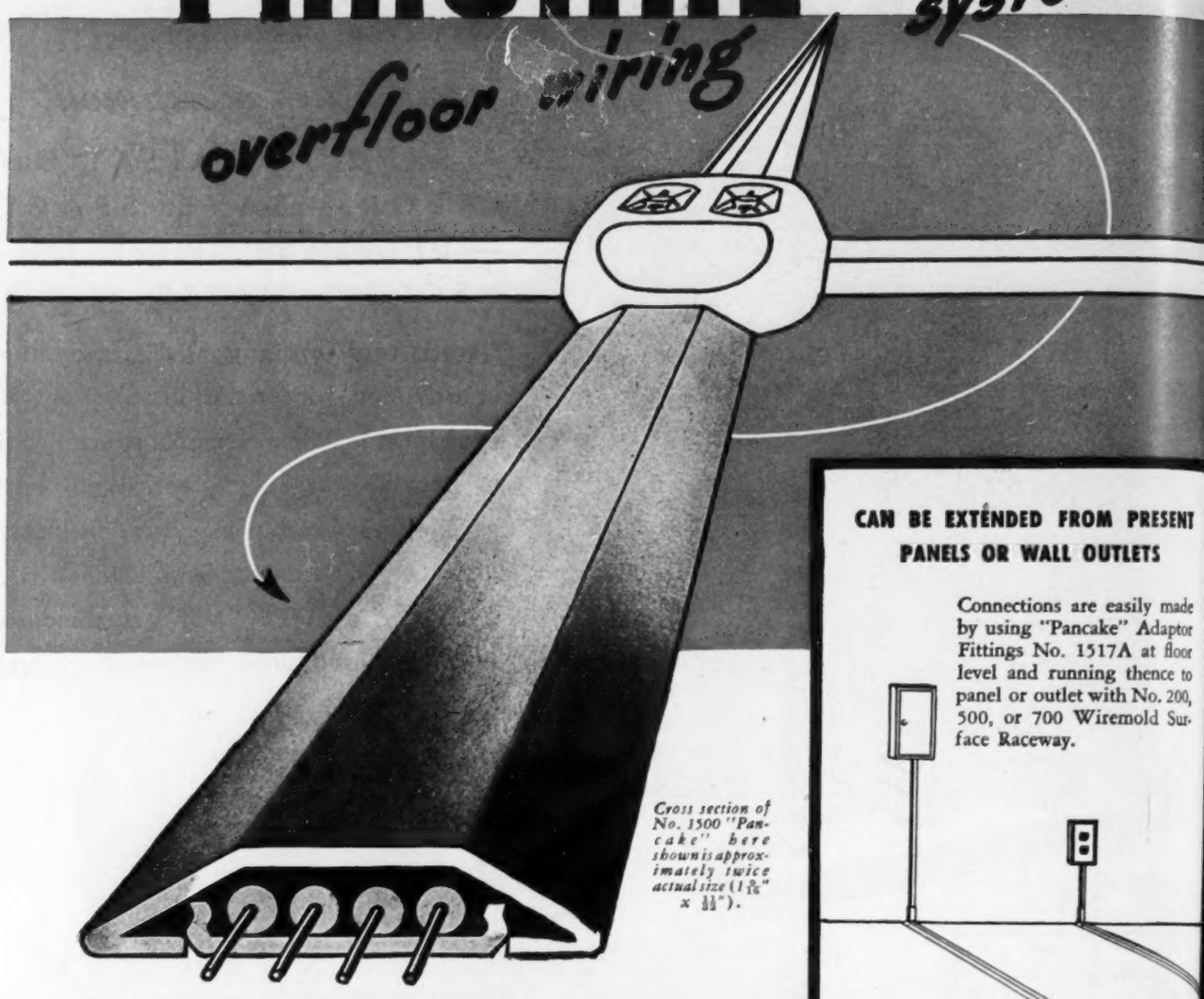
Specify TYPE "MSF" MULTIPLE SWITCH FUSE UNIT

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVENUE, CHICAGO, ILLINOIS, U. S. A.

IN CANADA—POWERLITE DEVICES, LTD. TORONTO

OTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

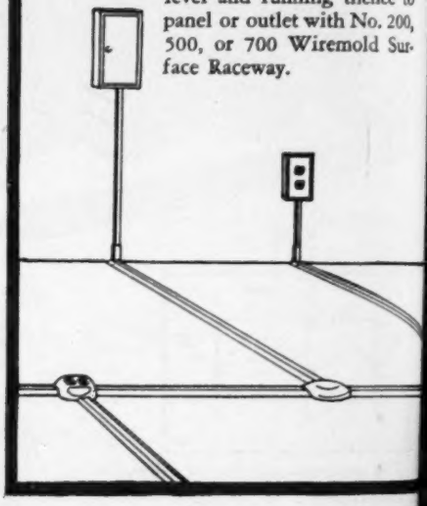
PANCAKE overfloor wiring systems



Cross section of No. 1500 "Pancake" here shown is approximately twice actual size (1 9/16" x 11/16").

CAN BE EXTENDED FROM PRESENT PANELS OR WALL OUTLETS

Connections are easily made by using "Pancake" Adaptor Fittings No. 1517A at floor level and running thence to panel or outlet with No. 200, 500, or 700 Wiremold Surface Raceway.



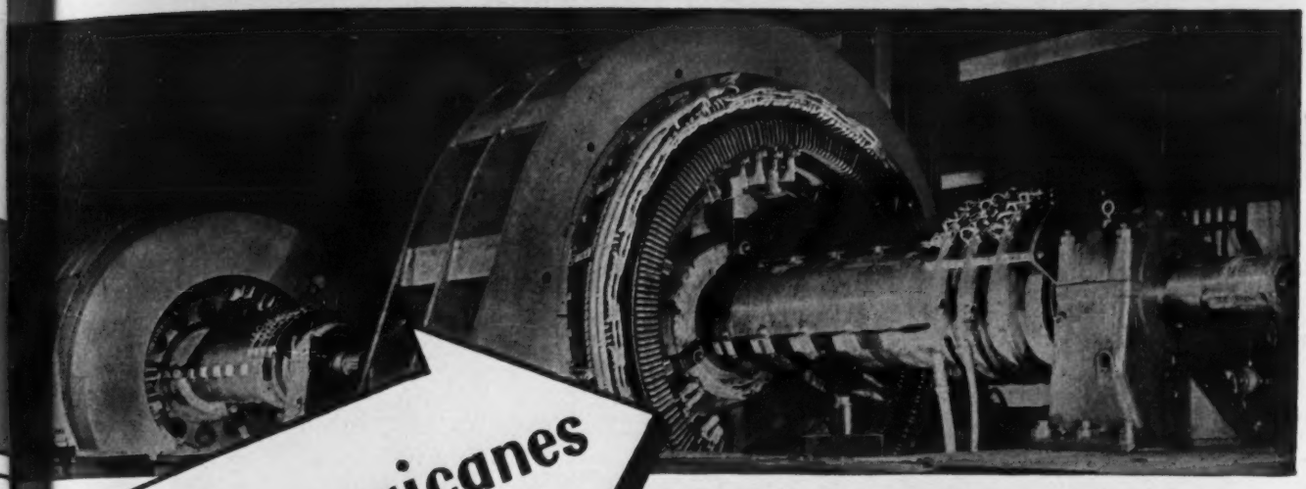
●Every architect, industrial engineer, plant or office manager knows that floor space represents investment... potential production capacity. Wiremold "Pancake," easily and quickly installed over any floor... "half a heel high and strong as a bridge"... trip-proof and unobtrusive... simplifies efficient planning. Two sizes and few simple fittings meet every requirement in carrying light, power or telephone and signal system wiring to desks, benches, office machines, factory hand tools and work lights, etc. Interconnects with existing wiring.

Know about this important Wiremold aid to efficient operation... readily extended or relocated for later needs. Conforms to Federal Specification W-R-32; listed by U.L. Available on suitable priority for essential installations. The Wiremold Company, Hartford 10, Conn.

Write for latest "Pancake" bulletins and engineering data sheets.

WIREMOLD CAN HELP YOU

PRODUCE FOR WAR... AND PLAN FOR PEACE



Where hurricanes

● *Six 6,000 h.p. SKF-equipped motors, built by Westinghouse, each to drive a 40-ft. propeller in the largest wind tunnel in the world, now under construction at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, California, for full-scale aerodynamic research.*

Imagine the loads imposed upon SKF Bearings as six 6,000 h.p. motors drive six giant propellers to provide the largest man-made windstream in the world in which scientific studies are to be made by the NACA to reduce the drag and increase still further the speed of America's airplanes. Radial loads run up to 70,000 lbs., thrust loads coming from the propeller up to 25,000 lbs. Bearings *must* be rugged to take such loads continuously . . . to help give our fighting planes more miles per hour than enemy planes can attain.

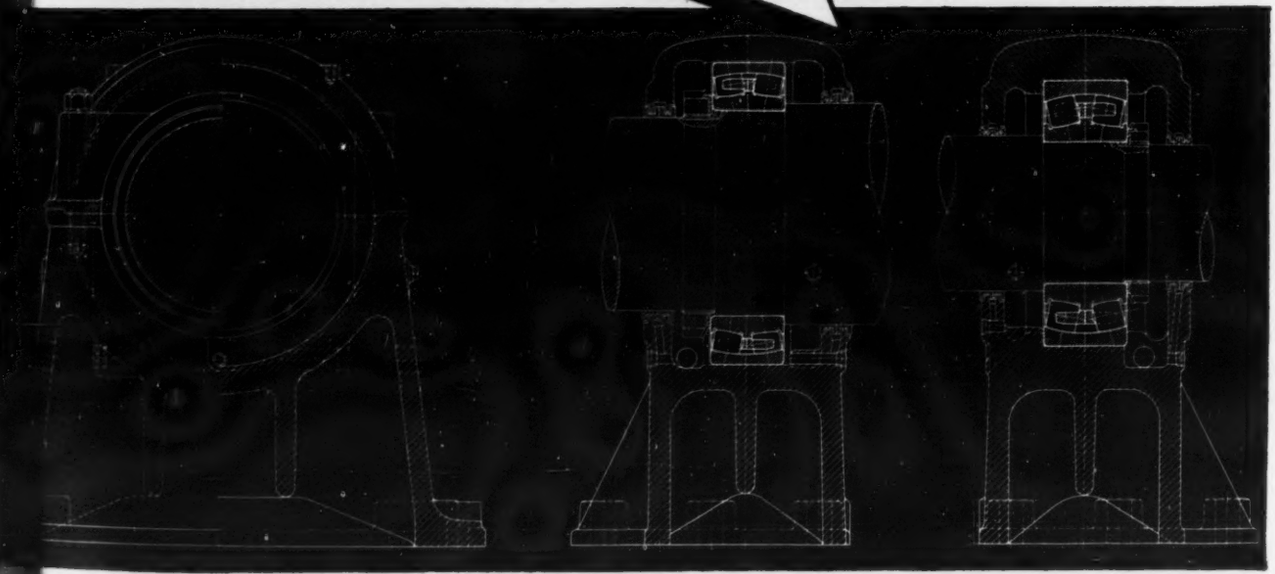
5414

SKF INDUSTRIES, INC., PHILA., PA.

rage on SKF

SKF

ROLLER BEARINGS



Along the railroad...

double corrosion resistanc

If you intend to install strand along a railroad, where clouds of corrosive engine smoke billow out around it, there is no need to go to the expense of non-ferrous materials which are generally restricted in use to more critical war needs.

Simply specify bethanized "B" or "C" coated strand, depending upon how severe corrosion conditions are.

Bethanized B-coated strand has a zinc coating that is twice as heavy as specifications call for in standard Extra-Galvanizing. Bethanized C-coated strand has a coating that is three times as heavy.

A.S.T.M. tests clearly indicate that the life of a zinc coating is directly proportional to its weight. This means you can expect double life from a bethanized "B" coating, triple life from a "C."

Superior weight, however, isn't the only good point of bethanized strand. Because it is applied by electricity, a bethanized zinc coating is absolutely unifo both *along* and *around* each wire. There are no t spots to give rust a foothold. The coating is 99.9+ p cent pure, ductile as gold leaf, and won't peel or cra when served or twisted.

For rural installations, where corrosion is not severe, we have available bethanized A-coated stra The "A" coating is the same weight as specificati call for in standard Extra-Galvanizing and has all the advantages inherent in the improved bethani process. Bethanized strand, in all coating weights, i sound economical buy.

★ ★ ★ BETHLEHEM STEEL ★ ★

(But how much better it would be if the truck had been equipped with emergency radio—like police radio—so that Joe could instantly summon help from the company.)

Of course. Hunt a phone. But suppose there is no phone near-by. What of Bill, then?

Accidents happen. And, because they happen, public utilities need emergency two-way radio equipment on each of their trucks, and at headquarters.

There are other reasons.

RCA emergency radio communications systems make maintenance and service men of all kinds more efficient.

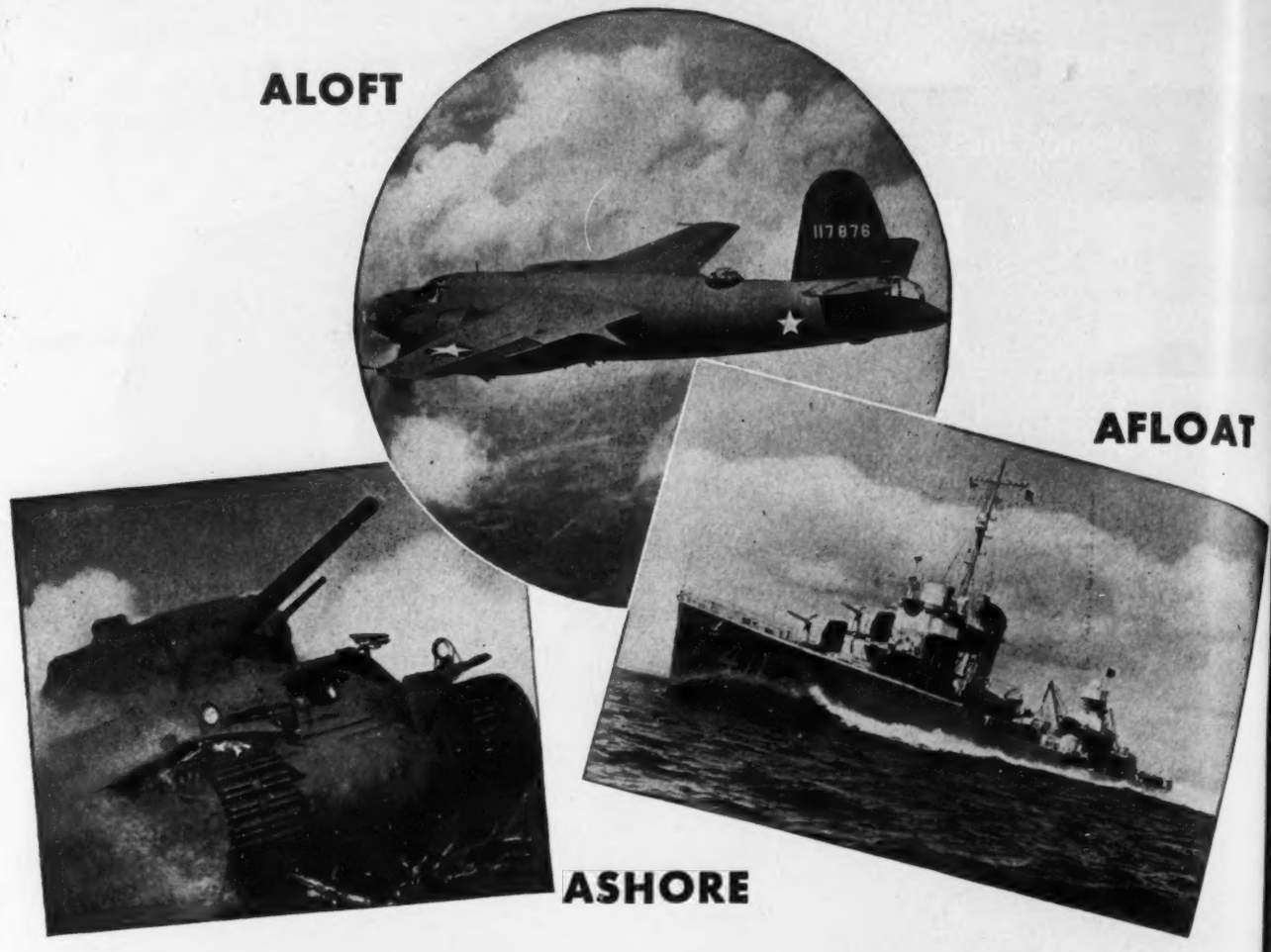
Such a system enables them to be directed to a new job as soon as the job they are on is finished. It provides ready means by which they can ask for instructions, advice, equipment, men, tools.

All this adds up to better service, faster service, shorter service interruptions, lower cost service.

RCA will gladly answer any questions about any type or application of RCA Emergency Communications Equipment. While availability of the equipment is limited by war priorities, any information you can give us now regarding your future need of such equipment will help us serve you better just as soon as the war permits.

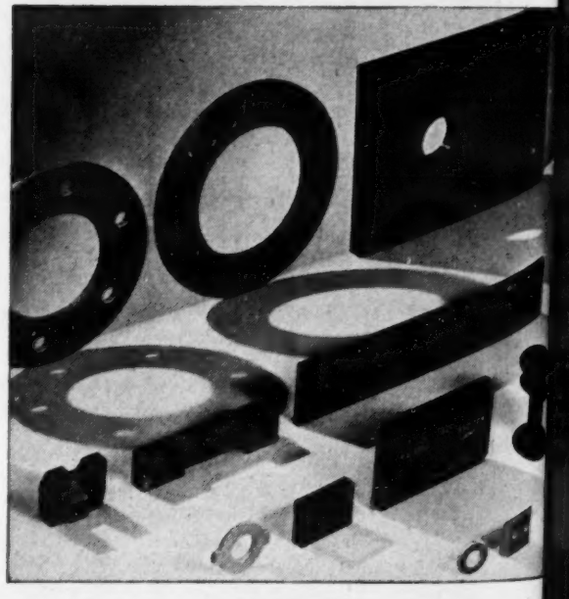
RCA EMERGENCY COMMUNICATIONS EQUIPMENT

RCA Victor Division • RADIO CORPORATION OF AMERICA • Camden, N. J.



A CONTINENTAL DIAMOND produc

is in there slugging!



C-D makes hundreds of electrical and mechanical parts which are vital to the successful operation of radios, guns, controls, communication systems, and all electrically energized units in our fighting equipment afloat, ashore and aloft.

Many of these applications posed new problems and conditions for NON-metallics. The research and experience which resulted has provided our laboratory with a wealth of "know how" which is at your disposal to help solve your "What Material?" problems.

C-D products include THE PLASTICS... DILECTO—a laminated phenolic: CELORON —a molded phenolic: DILECTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre: VULCOID — resin impregnated vulcanized fibre: and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities

CD-43

Continental-Diamond FIBRE COMPANY

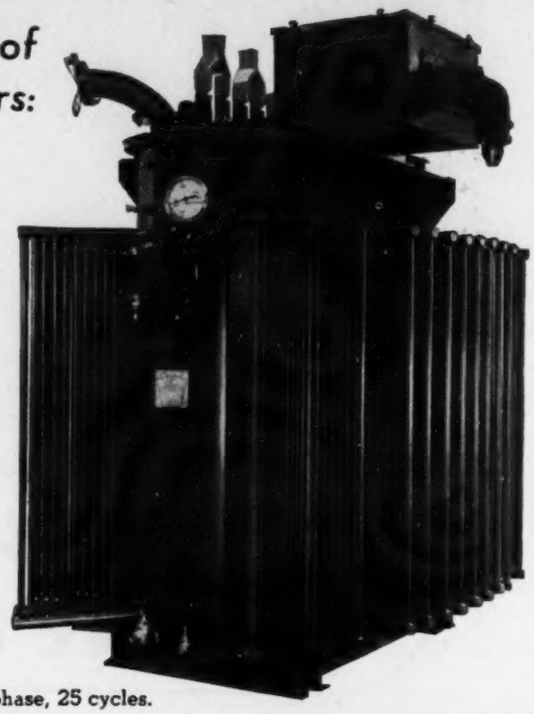
Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

For convenience and economy of transformer installations indoors near the load centers

Ask for Askarel

Pennsylvania's noninflammable, non-explosive, liquid-filled transformer

Check these outstanding qualities of Pennsylvania Askarel Transformers:



3000 kva, ASKAREL, 3 phase, 25 cycles.

Circular Coils Possess Maximum Inherent Strength

In regular oil-cooled transformers, varnish is used to increase the mechanical and electrical strength of the transformer coils, irrespective of the shape of the coils. This kind of varnish, however, cannot be used to treat coils in a transformer where noninflammable liquids are employed. Therefore, without the aid of this varnish, it is imperative that the coils in a noninflammable transformer have great inherent strength. Pennsylvania circular coils possess the maximum inherent mechanical and electrical strength!

Radiators Built to Withstand High Pressures

Askarel transformers develop high pressures inside the tank because of the sealed, pressure-tight, tank construction necessary to prevent loss of Askarel through evaporation. Sturdy Uni-Row radiators on Pennsylvania Askarel transformers are designed to meet these high pressures. As rugged as the tanks themselves, these radiators are premanently welded in position and tested at 100 lbs. pressure. Radiators are spaced around the tanks so that each tube of each radiator is easily sandblasted, cleaned and painted.

Self-Reclosing Safety Valve Relieves Excessive Pressures.

Safety valves are mounted on the covers of all Askarel transformers above 25 kva, and operate in case abnormal pressures exceeding 12 pounds per square inch develop inside the tanks. These safety valves are self-reclosing to prevent foreign matter from entering the transformers.

333 kva, ASKAREL, 1 phase, 60 cycles.

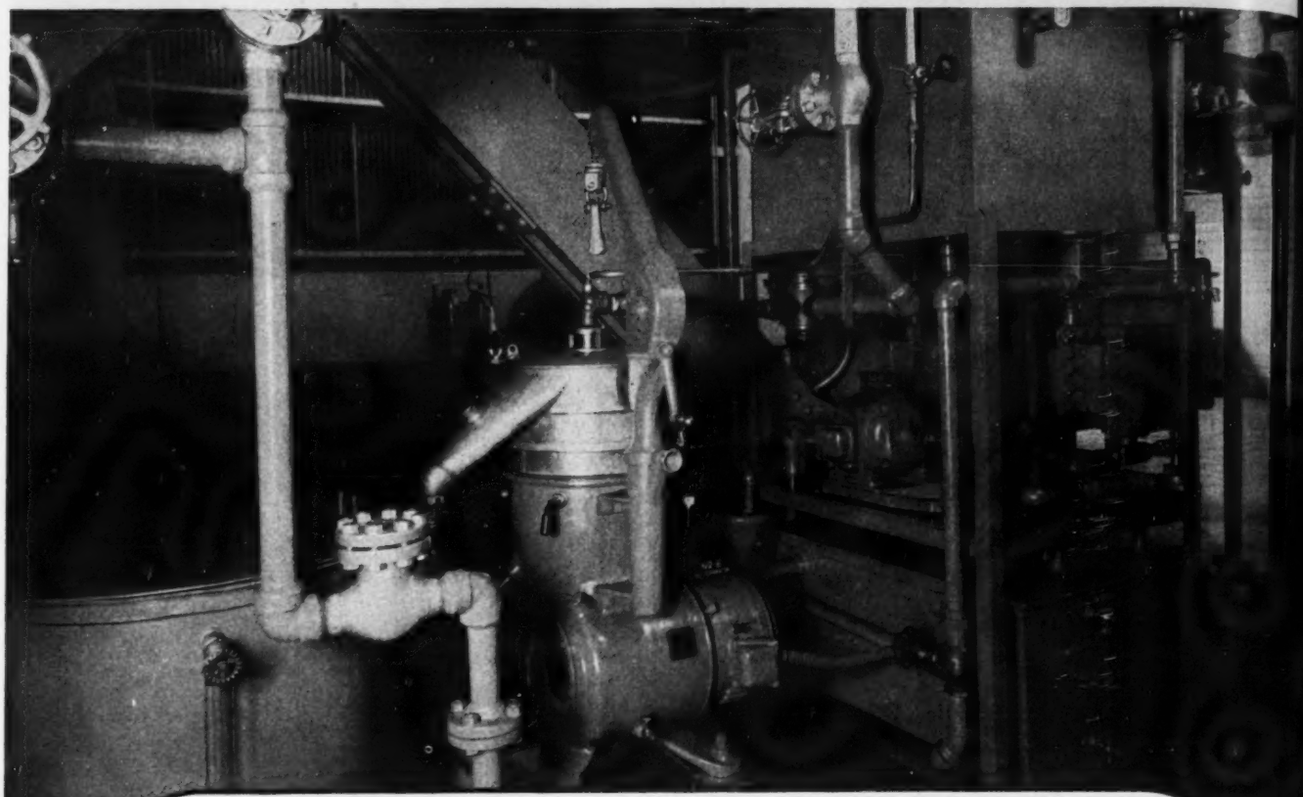
25 kva, ASKAREL,
1 phase, 60 cycles.

Pennsylvania
TRANSFORMER COMPANY
PITTSBURGH, PENNSYLVANIA

Pennsylvania TRANSFORMERS

- Since Askarel Transformers are noninflammable and nonexplosive, they may be installed indoors at the load centers without a vault or fire door.
- Since Askarel is nonsludging and nonoxidizing, and the transformer tanks are pressure-tight and moisture-proof, Askarel-transformers may be installed outdoors as well as indoors.

This DE LAVAL-FUNK PROCESS *is*



The "Last Word" in Efficient TURBINE OIL PROTECTION

THE De Laval-Funk Process shown above is installed in one of the great central stations in the East. All of the oil used to lubricate the turbines in this giant power plant is processed and centrifugally purified by this means, greatly reducing the formation of sludge within the turbine lubricating system, and assuring that only purified oil returns to the turbine reservoir.

Operators of all forms of prime movers who are charged with the trouble-free maintenance of their equipment, know that De Laval Oil Purifiers protect vital bearings by keeping the lubricating oil free from dangerous impurities, including water.

De Laval Centrifugal Oil Purifiers maintain oil in a condition most nearly identical with that of new oil and make possible uniformly high purifying efficiency, with long, trouble-free service.

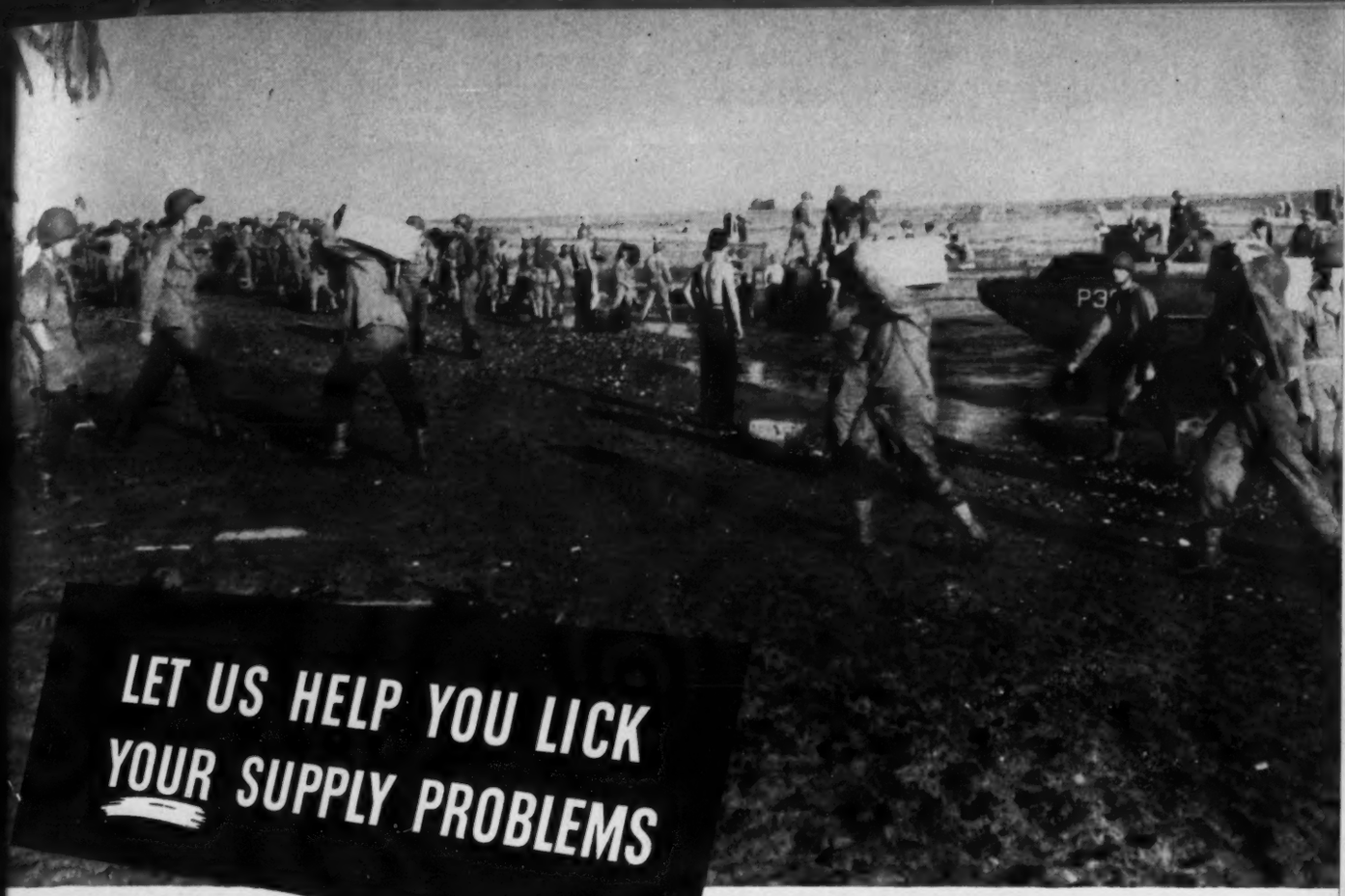
Both De Laval Oil Purifiers and the De Laval-Funk Process are available in various capacities and are equally well adapted to small power plants.

Write for bulletin giving details

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York, 6 427 Randolph St., Chicago, 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco, 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL *OIL PURIFIERS*

FOR MORE DEPENDABLE POWER PRODUCTION



LET US HELP YOU LICK YOUR SUPPLY PROBLEMS

Call us for General Purpose Steels

Our business is to help you keep war production moving, so if you need steel we'll get it to you in a hurry if at all possible—subject, of course, to priority restrictions. We can't always fill *all requests* because of material shortages, but a call to us has solved many a supply problem. If you need steel, steel products, machinery or equipment, try us. Write, phone or wire our nearest warehouse. You will get prompt, courteous attention.

We Welcome Inquiries On National Emergency Alloy Steels

These new steels have made it possible to meet many critical conditions imposed by the shortage of strategic alloys. They have given satisfactory results—in fact, have sometimes performed even better than the steels previously used.

We'll gladly assist you in determining the grades best suited to your needs. Get in touch with our nearest warehouse.

Get Extra Service From Your Equipment

Do you find equipment wearing out in areas subject to great abrasion or corrosion—while the rest of the equipment is still in good shape? You can prevent this premature breaking-down of equipment—save time, money and metal—by depositing a tough, wear-resisting surface over such areas with Bergstrom Hard Surfacing Electrodes.

These electrodes are easy to use. Applied in any position. AC or DC, with freedom from porosity. Freedom from scale eliminates brushing and chipping.

Write for Free Information

We will send you full information, including an outline of the purposes of each of the six types of electrodes available.

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		REctor 2-6560 -	BErgen 3-1614
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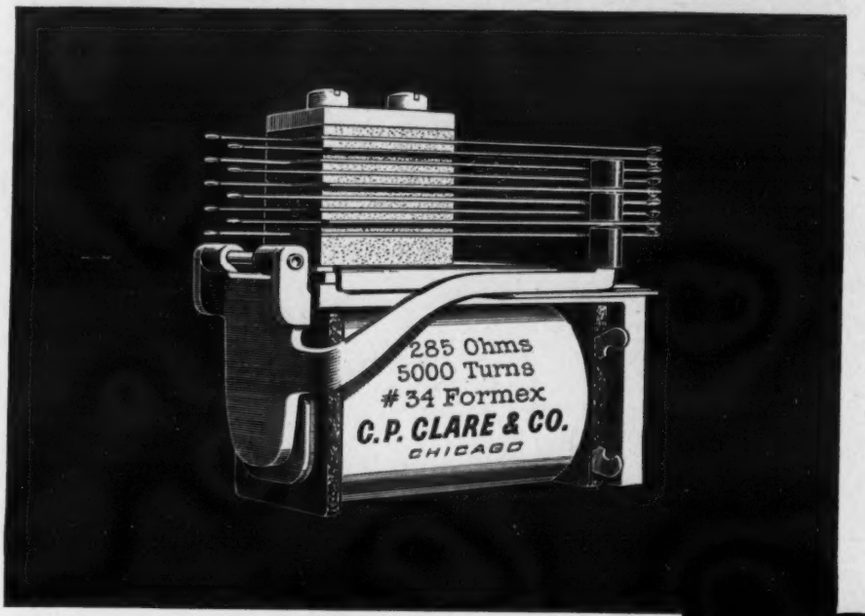
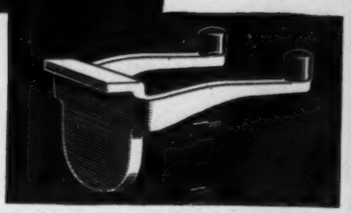
UNITED STATES STEEL



CLARE *"Custom-built"* RELAYS
for control panels



Double arm armature assembly of stainless steel shaft, operating in a marine brass yoke. Heel piece, core and armature assembly of magnetic metal.

In spots where hard service, long life and dependability are of prime consideration, Clare Type G "Custom-Built" Relays have a wide range of utility applications.

These simple, rugged, multiple contact relays are especially valuable for use in operating control panels, supervisory control boards and load dispatching centers where signals are indicated from remotely located switches, circuit breakers, network protectors and other equipment.

Innumerable contact arrangements supplied by the Clare Type G Relay permit its adaptability to a wide variety of applications.

Behind this versatility and dependable operation are these unusual construction features:

Standard spring assemblies may embody any combination of five basic contact arrangements.

Coils are carefully wound to exact turns on precision machines.

Leadout wires are securely soldered. Coils are protected with a transparent acetate covering, and are available impregnated with special varnish.

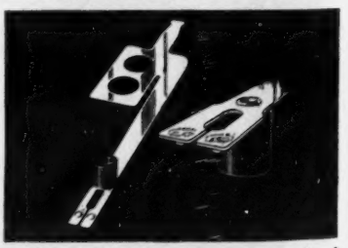
Octal base plug mounting is available. This makes for easy service and replacement. Other types of mounting, such as individual angle bracket, strip or panel, can be furnished.

All Clare Relays are carefully designed, precisely manufactured from finest materials and accurately adjusted. These factors assure that the Clare Type G Relay will reduce overall relay cost, simplify installation and insure better and more dependable performance.

Clare engineers are ready at all times to assist in the development of a Clare "Custom-Built" Relay to meet any new and unusual requirement. Send for the Clare catalog and data book. C. P. Clare & Company, 4719 West Sunnyside Avenue, Chicago (30), Illinois.

High voltage spring pile-up insulators of special heat treated Bakelite. Has minimum cold flow properties, low moisture absorption content; and permits punching without cracks or checks.

Contacts are welded to nickel silver springs by special process. May be of precious metals or alloys in 12 different standard, or special, types and sizes.



Spring bushing insulators are made of Bakelite rod under patented process. Resist vibration and withstand heavy duty service.

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial U

NO QUESTIONABLE PORCELAIN CAN SURVIVE THIS TEST

Lapp suspension insulator units, before being approved for shipment, must withstand the Overpotential Test, the industry's most severe test of porcelain quality. Its rim immersed in oil to prevent flashover, the unit is subjected to 60 cycle current at voltage higher than rated flashover value. Porcelain not up to the Lapp standard, punctures in this test, never gets a chance to fail on your lines. Units that survive are assured a definite dialectric factor of safety. The Overpotential Test is one of the many reasons that you do better with Lapp insulators on your lines. May we tell you the whole story? Lapp Insulator Co., Inc., LeRoy, N. Y.

Lapp

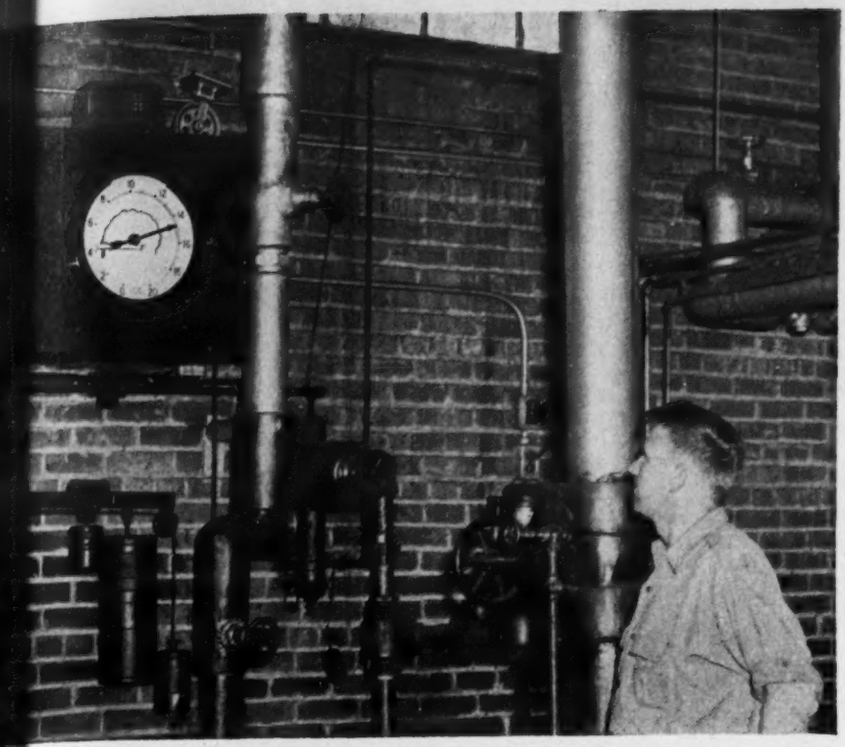
Better Porcelain • Better Insulators

PLEASE LIMIT YOUR CALL TO FIVE MINUTES

When a Long Distance circuit is crowded the operator will say: "Please limit your call to five minutes."

Observing this time limit on essential calls, and avoiding all unnecessary calls, will help the whole war effort.

BELL TELEPHONE SYSTEM



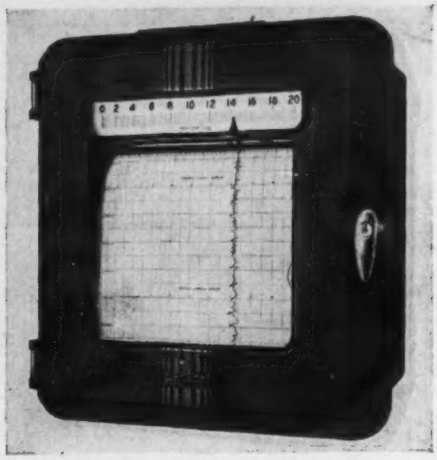
…d high above the floor so that it can be read far down the firing aisle, this Micromax Round-… CO_2 Recorder helps a New York State plant to save coal by improving combustion beneath …ker-fired boilers.

…RYING TO SAVE FUEL?

…aybe a Micromax CO_2 Recorder Can Help

…reed by the Micromax CO_2 Re-…er from the job of analyzing flue-…at frequent intervals, many a plant …neer is saving fuel simply because …nows more about CO_2—and knows …ore quickly — than ever before. … when the Micromax shows the … of a change in air supply to the …er, the engineer makes the cor-…ion with speed; and quickly sees … result on the Recorder's chart. He …n tell, from minute to minute if he …es, just how combuston stands in …tion to optimum efficiency. And … has the CO_2 records to help plan …ure operating savings.

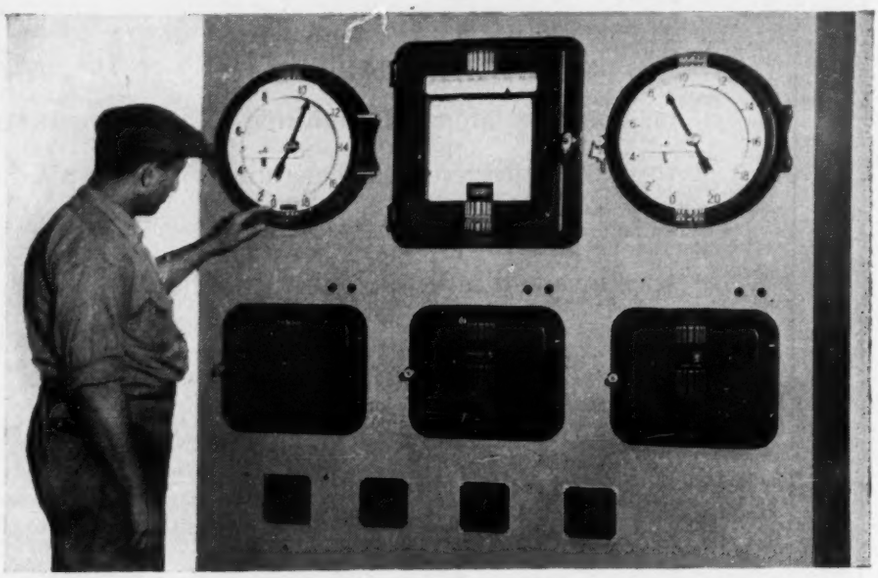
One of the outstanding successes of …dern instrumentation has been …ved by this Recorder. Coming into … power field when CO_2 recorders …re widely regarded as not practical, … instrument was on a "make good … you can" basis in every early …tallation. Two or three types of CO_2 …ers were already available; the …val of still another didn't rouse …h comment—at first.



The Strip-Chart form of Micromax CO_2 Recorder is preferred by some users.

But the comment came quickly enough after a few installations had been made, because the new device overcame the standard objections to automatic CO_2 meters—it was sensitive, it was not easily damaged in use, and it required practically no servicing. Users checked it, found it accurate; could see for themselves its other qualities; came to depend on it.

Today, wherever any thermal-conductivity-method recorder can be used, these advantages of sensitivity, sturdiness and low maintenance can be enjoyed. If you have a CO_2-analysis problem, one of our engineers will gladly tell you more about Micromax. If you prefer a quick, clear-pointed description, ask for Catalog N-91-163.



Micromax Recorders for Flow, Temperature and CO_2, being mounted, together with Metermax Combustion Control, on a boiler-control board before shipment from our plant. These panels arrive ready for connection to boiler, etc.; greatly simplify the installation.

…depends on me!

…ogan For Every American

LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

…N-91-163(12)

First of a series of statements about ETL *comprehensive services*

COMPREHENSIVE SERVICES IN PROMOTION OF GOOD QUALITY IN LAMPS AND LIGHTING

For assistance to their competent endeavors to produce best quality lamps the independent services of ETL for inspections and tests in lamp factories are retained by

GENERAL ELECTRIC COMPANY

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

ETL is called upon to make continuous independent determinations of quality; assisting the manufacturers to produce and ship the best possible products.

This is one of the elements of ETL's *comprehensive services* in connection with lamps and lighting. ETL testing at lamp factories attains to higher effectiveness than otherwise it could because it is coordinated with testing and research at ETL headquarters and with inspections and investigations in the field.

ETL services are available to any manufacturer and to purchasers of his product who care to avail of them.

ELECTRICAL TESTING LABORATORIES, INC.

2 EAST END AVENUE AT 79th STREET, NEW YORK 21, N.Y.

"FIRE POWER"—

IS A LIABILITY

"Fire Power" is a two-edged force. Applied by our weapons of war, it is driving the enemy nearer and nearer to complete defeat. Created by combustibles, and allowed to attack vital electrical generating equipment, "fire power" can cause crippling delays of war production in an entire community.

Cardox Fire Extinguishing Systems are helping assure plenty of *effective* fire power for our fighting forces by guarding against *destructive* fire power both in power plants and in factories producing such critical war products as:

Airplanes, Airplane Parts, Armor Plate, Aviation Carburetors, Aviation Engines, Cold Strip Steel, Engine Parts, Forgings, Motor Fuel, Plastics, Processed Fabric, Rubber Products, Solvents, Tanks, Tank Engines.

An extremely wide variety of indoor and outdoor hazards—large or small—can be efficiently protected by individually engineered Cardox Fire Extinguishing Systems. By instant smothering of fire and cooling of combustibles through the discharge of low pressure, low temperature carbon dioxide, they provide the all-important advantages of fast, complete extinguishment . . . *without damage to plant and equipment by the extinguishing medium.*

Today Cardox is concentrating on (1) Fire Extinguishing Systems needed to insure more effective "fire power" for our Armed Forces; (2) plans to increase the efficiency of fire protection, both today and after the war.

If you would like more information, write on company letterhead for Bulletin 5113.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in New York • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle

How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

HOW *PRECIPITRON*★ WORKS

Tests show 99½% of dirt removed by *Electric* Air Cleaning

Uncleaned air, from intake.

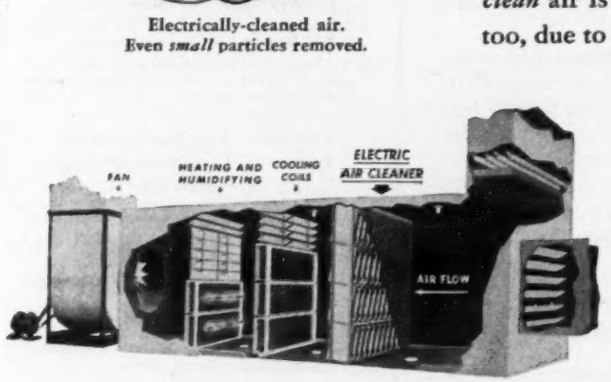
Mechanically-cleaned air.
Large particles eliminated.

Electrically-cleaned air.
Even *small* particles removed.

While there are many other methods of removing dirt from the air, none approaches the efficiency of *electrical* air cleaning. Blackness Tests—newest and most accurate means of determining air cleaning efficiency—show that Precipitron, the Westinghouse *Electric* Air Cleaner, removes more than 90% of ALL particles down to 1/250,000 of an inch in diameter (or on a weight basis, 99½% of *all* the dirt).

In making these tests, air is taken from the intake and exhaust sides of an installed air cleaning unit and passed through separate chambers containing small pieces of porous paper. The dirt in the air adheres to this paper—and upon completion of the test, the difference in "blackness" between the two pieces is determined, providing an accurate measure of the air cleaner's efficiency.

The three circles at the left are representative of the results obtained. While ordinary air cleaners do remove a lot of dirt, they permit from *12 to 30 times as much dirt to get through* into the circulating air as an electric air cleaner. This accounts for Precipitron being consistently chosen for those installations where really *clean* air is of vital importance. And for many other installations, too, due to its high efficiency and low operating cost.



Cross section of Precipitron installation in typical air conditioning duct.

Today, Precipitron Electric Air Cleaning protects precision parts from air-borne grit and dirt . . . cleans ventilating air for large rotating machinery in steel mills and power plants . . . removes oil mist and welding fumes . . . performs many other important jobs for America's War Industries. For full information on Precipitron and its applications, write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio.

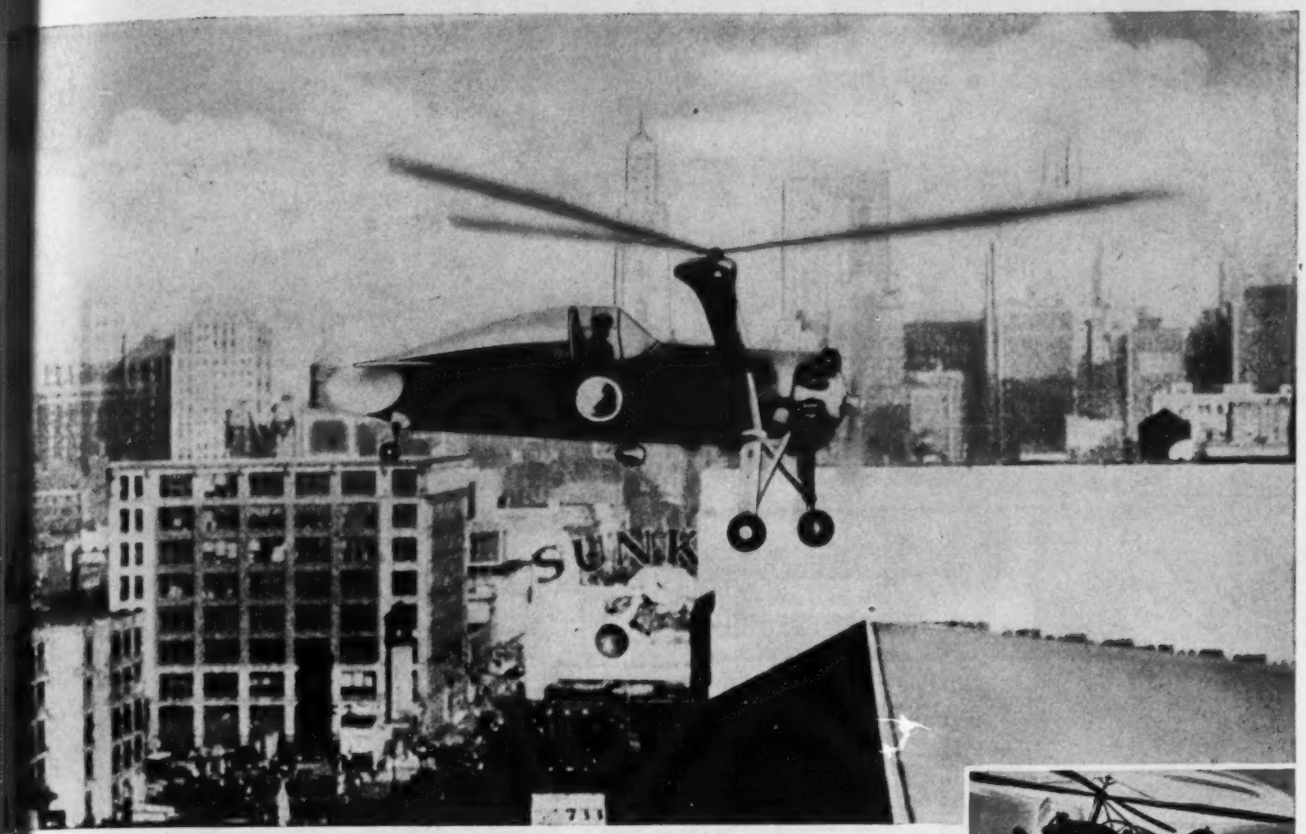
*Trade-mark registered in U. S. A.

Westinghouse Precipitron

PLANTS IN 25 CITIES ○ OFFICES EVERYWHERE

Tune in on John Charles Thomas, NBC, Sundays, 2:30 p.m., E.W.T

Electronics at Work



The Eastern Air Lines KELLETT which flew mail for a full year from the roof of the Philadelphia Post Office. One of many Kellett "firsts" in its years of pioneering the manufacture of rotary wing aircraft.

THE PIONEER LOOKS TO TOMORROW

TODAY in cooperation with the U.S.A.A.F. Kellett is speeding the engineering development and production of autogiros and helicopters for military needs. We cannot give details now. Five Kellett plants are also applying their aeronautical ingenuity to the production of important parts for some of America's most famous fighters and bombers — Thunderbolts, Liberators, Warhawks and Marauders . . . while an expanding corps of forward-looking engineers continues Kellett's rotary wing developments for the future.

TOMORROW we look forward to opportunities for Kelletts to cut time and costs in patrolling electric power lines, oil pipe lines, in transporting mail and passengers, dusting crops—and in a wide variety of services for industry, commerce, forestry and agriculture. Kellett's years of experience and accomplishments continue to attract pioneering minds, men who, with us, see vast opportunities for rotary wing progress in the post-war era. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

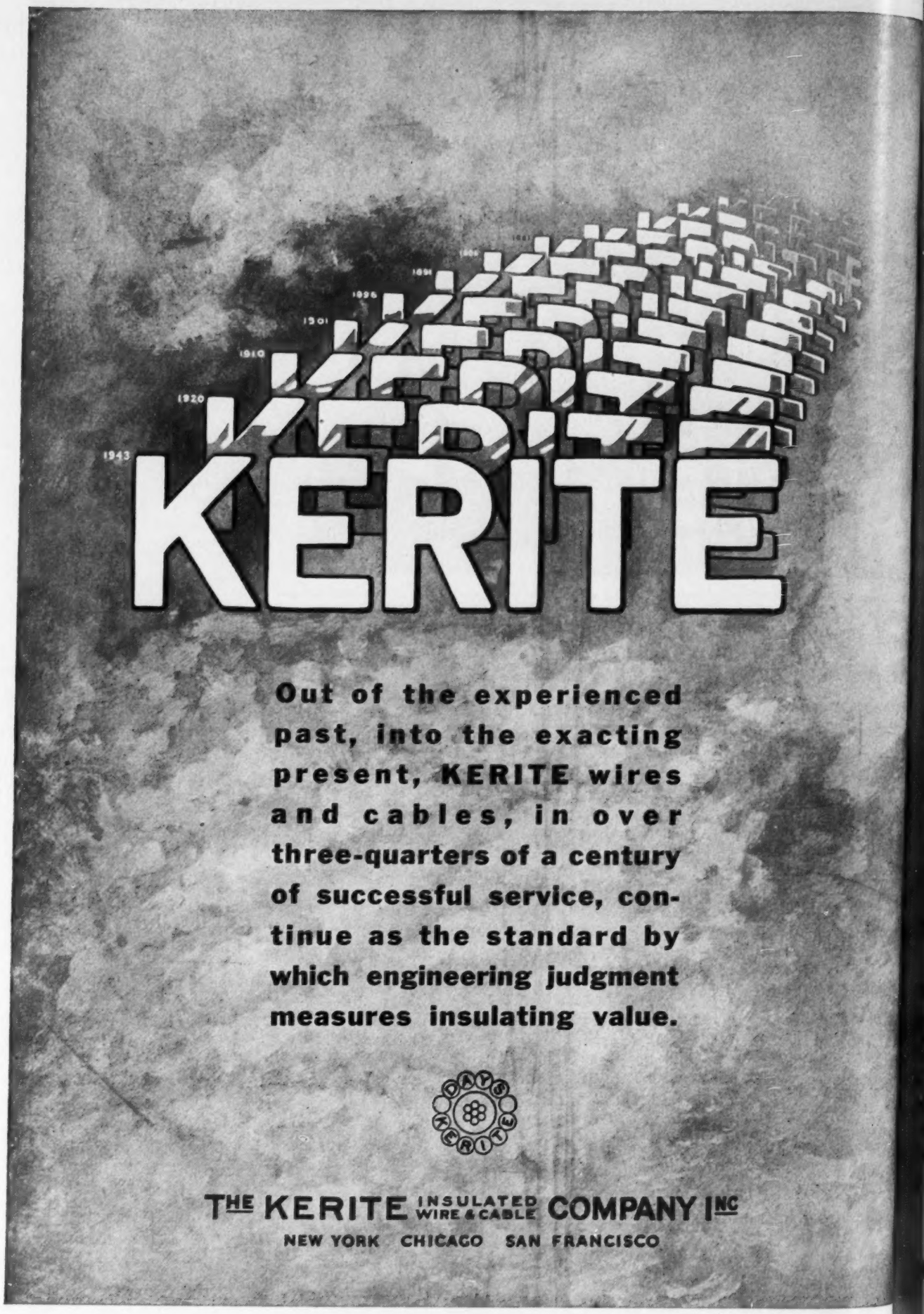
A Kellett accompanied Admiral Byrd on his voyage to the South Pole.

Border-patrol use is dramatically demonstrating Kellett serviceability.

. . . and Kellett is looking to a future of expanding service to the nation.

K E L L E T T

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY


1894
1896
1901
1910
1920
1943
KERITE
KERITE
Out of the experienced past, into the exacting present, KERITE wires and cables, in over three-quarters of a century of successful service, continue as the standard by which engineering judgment measures insulating value.
THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

The Elixir of Life

The privately owned electric utility indus-y has but one major post-war incentive, and hat is to live. Unlike other non-regulated busi-esses, it cannot make any greater return on its nvestment. In fact, there is every reason to be-eve that it will receive a smaller and smaller eturn as the years roll on.

Some people might think that such an in-entive would develop a defensive attitude and hereby give rise to an overpowering pessimism. n the contrary, such realistic admission of the ndustry's primary incentive might be the very hing that will arouse effort and bring healthy ptimism.

Right now public opinion is more than half ay convinced that free enterprise and private itiative offer a better opportunity to the work-rs than government operation. A little later on, hen the threat of totalitarianism has died down, ere is no reason to believe that the public will ot once more be receptive to the propaganda of e public ownership crowd.

There is only one lasting way to defeat em, and that is to give residential customers tes so low that they leave the agitators little or thing to offer the voters. Regardless of how od a record the industry has in reducing rates er the years, if the public is offered municipal nership at greatly reduced rates the private ility is going to have to fight for its existence the polls.

Is there any dilemma in greatly lowered rates and a fixed return? We do not think so. In fact, the two together point the way to the very thing that America needs after the war—greater employment.

Most competitive businesses start out by setting a price that will gain more volume from which is expected a greater return. Except for the fact that the rate of return cannot be increased, this is pretty much the pattern for utility consideration.

Take the goal, as was suggested in these columns last month, of double the residential usage in the next five years. What would be necessary in the way of rate incentives to sell that usage in that time? Would it be possible by changes in operating methods and construction standards to make the allowable return at those rates? Would those rates be so low as to offer little or no incentive to municipal ownership?

There is the real problem of tomorrow. To some it can look like a dreary treadmill—always striving and never getting anywhere. To others, however, it presents a beautiful sunrise of opportunity. It is the one policy by which the privately owned industry can not only continue to exist but can expand and grow faster than ever before, and in so doing increase its investment base on which by planned load building it can earn more dollars even if the rate of return goes down.

It is the elixir of life.

Arc Furnace Line Extensions Save 62 Tons of Copper

Careful planning of four electric arc furnace installations results in saving of critical materials by rearrangement of circuits, utilization of reserves, expedient switching — Flicker limits often exceeded, but without complaint

B. M. JONES, Planning Engineer, Duquesne Light Company, Pittsburgh, Pa.

SAVING of 124,000 lb. of copper in transmission line extensions to four electric arc furnace plants was accomplished as a result of thorough study of the requirements, particularly a review of the available transmission reserve built into the system for peacetime requirements to determine if we could utilize it to save copper. Savings in lead of 19,847 lb. and 5,840 lb. of steel were also made, and there were additional savings in copper and steel in the substation equipment and structures and in line towers, due to the fact that they were not built; that is, additional lines were not built and hence the substation terminals were not required.

Reserve Circuit Used

*Item F-3**—Copper and lead were saved (Table I), a considerable amount of transmission reserve was utilized, and the voltage flicker limit was not exceeded.

This was an existing industrial plant (Fig. 1) which was starting to install three 3,000-kva. furnace transformers. The two 11-kv. underground cables are 500,000 cir.mil. and are each about 0.6 mile in length. Previously, the plant had been supplied from the 11-kv. network in this vicinity.

Two exclusive lines supplying this customer from the power station 11-kv. buses were provided by cutting, splicing and rearranging existing 11-kv. underground cables in this vicinity. This resulted in practically confiscating one entire 11-kv. circuit from the power station to the immediate vicinity of this plant, which circuit had been used for reserve for other substations in this district.

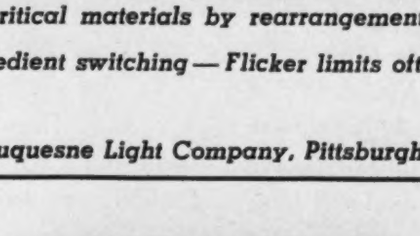


FIG. 1—Cutting, splicing and rearranging 11-kv. lines (including a reserve) saves nearly 8 tons of copper and 10 of lead in serving three 3,000-kva. furnaces

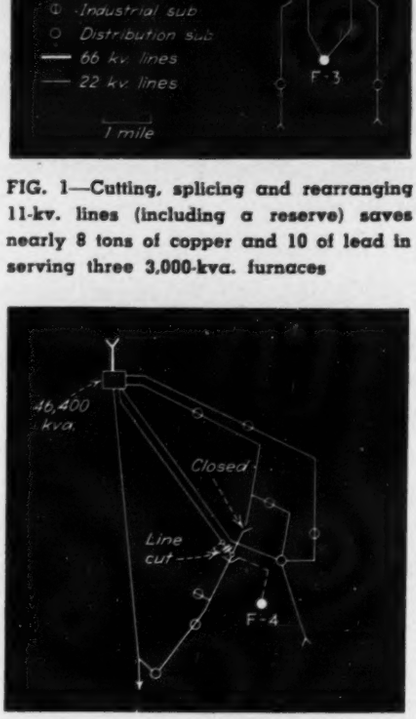


FIG. 2—Over 26 tons of copper saved by circuit rearrangement to serve 5,500 kva. of furnace load

Circuits Rearranged

Item F-4—Transmission reserve was utilized, thus saving copper, and the voltage flicker limit was not exceeded.

One 1,200-kva. furnace had been changed to 1,500 kva. about 1941. The proposed new 4,000-kva. furnace installed in 1942 required a separate source of supply to keep the intolerable flicker off the system in this vicinity.

The exclusive line (Fig. 2) is 5.5 miles long and consists of No. 1/0 copper; it was made available by rearrangements in the 22-kv. transmission system in this district, with an extension of about 1.5 miles of No. 1/0 circuit in the immediate vicinity of the customer. Old and new furnaces are both now carried by this exclusive line. A throw-over switch was installed in the 22-kv. bus in the customer's substation to transfer the furnaces to the regular 22-kv. transmission system in this vicinity in case of failure of the exclusive line, and under such conditions the furnaces, particularly the larger one, may have to reduce the tap connections during the meltdown period.

Circuits Switched

Item F-6—Copper was saved (Table I) by using a very considerable amount of transmission reserve. It is expected that the voltage limit will not be exceeded.

This plant had had no electric arc furnaces; the new furnace installation consists of a 7,500-kva., three-phase electric arc furnace for steel making, scheduled to be in service the middle or latter part of 1943.

This customer is supplied by an existing No. 4/0, 22-kv. line 4.7 miles long, and the portion shown dotted (Fig. 3) is the extension to reach the customer from the existing line. The switch marked "open" will be normally operated open when the fur-

* This and other like designations are of items in tables and of furnace locations in figures.

nace is in the meltdown period, but can be closed when required if the furnace performance is not too violent. Actually, this switch will be located in the 4-kv. distribution substation shown near by, which is an unattended automatic substation, and the switch will be remotely controlled by the attendant in the 60,000-kva. transmission substation, several miles away. In case of an emergency with a 22-kv. transmission line out of service in this vicinity, this switch will probably be closed and instructions issued for some restricted operation of the furnace for the short period of time required to restore the line, and that was the reason for installing the switch.

Transmission Reserve Used

Item F-8—32,630 lb. of copper and 5,840 lb. of steel were saved, and some transmission reserve was utilized and the voltage flicker limit was not exceeded.

This is a new war plant for making steel by electric arc furnaces and the installation consists of two 10,000-kva., three-phase electric arc furnaces scheduled for service in the middle or latter part of 1943.

This plant will be supplied by one No. 1/0, three-phase, 66-kv. transmission line (Fig. 3) with two overhead ground wires on wood poles, and will be approximately 1.9 miles long. The 1.9-mile line extension is connected onto the main 66-kv. transmission system. In peacetime we would probably have made a loop of this installation and the size of the copper in both sides of the loop would have been No. 4/0 instead of No. 1/0 to match the existing transmission lines.

No Flicker Complaints

Item F-1—No direct savings in copper for line extensions were made as the present 22-kv. lines were used, but transmission reserve was utilized, thus indirectly saving copper. The peacetime voltage flicker limit is being exceeded by 48 per cent at the nearest distribution substation, but no complaints have been received.

This was an existing customer for a number of years, having two electric arc furnaces, and some time in 1942 a 1,200-kva. furnace transformer was replaced with a 2,000-kva. unit, at which time some modification was made in the furnace. This increased furnace transformer capacity naturally produced definitely perceptible lighting flicker, but no complaints of objectionable voltage were received.

This plant was supplied at 22 kv.

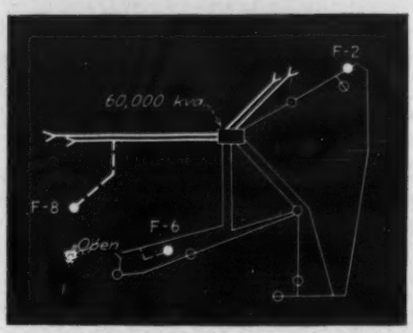


FIG. 3—Eliminating transmission reserve for a 20,000-kva. furnace load in one plant and a 7,500-kva. load in another averts the use of 28 tons of copper and 3 tons of steel

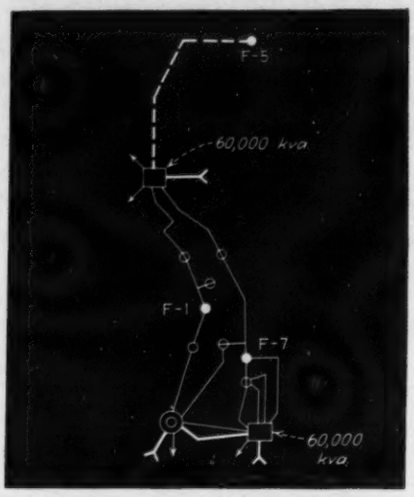


FIG. 4—Furnace loads fed from looped feeder and reserves sacrificed to carry other furnaces

Table I—124,000 Lb. of Copper Saved in Providing Transmission Lines for Four Electric Arc Furnace Plants. Transmission Reserve Utilized in Supplying These and Other Furnace Plants

Item Number	Figure Number	Copper Used in Line — Wartime Actual	Probable Copper Use — Peacetime	Copper Saved — Pounds	Transmission Reserve Utilized	Furnace Transformer Size
F-1	1	Lines available; larger transf. installed on existing furnace.		0	Yes	1-1,200
F-2	2	Lines available; larger transf. installed on existing furnace.		0	Yes	1-3,000 Two smaller
F-3	1	Cu 3,823 Lead 6,423	19,040 26,270	15,217 19,847	Yes Considerable	3-3,000
F-4	2	Cu 11,000	64,000	53,000	Yes Considerable	1-4,000
F-5	1	Same in War or Peace		0	Yes	2-6,000
F-6	2	Cu 3,500	27,500	24,000	Yes Considerable	1-7,500
F-7	1	Lines available; only minor rearrangements required.		0	Yes	2-7,500
F-8	2	Cu 12,330 Steel 5,840	44,960 11,680	32,630 5,840	Yes	2-10,000
Total Pounds Saved	Copper	30,653	155,500	124,847	In conductors only—additional savings in substa. equip., etc.	
	Lead	6,423	26,270	19,847		
	Steel	5,840	11,680	5,840	In O.H. ground wires only—additional savings in substa. structure and line towers.	

by a No. 4/0 line 7.1 miles long from a power plant and by a No. 1/0 line from a transmission substation (Fig. 4). The furnace substation is looped between two 22-kv. lines.

Flicker Limits Exceeded

Item F-2—No direct savings in copper for line extensions were made as the present 22-kv. lines were used, but transmission reserve was utilized, thus indirectly saving copper. The peacetime voltage flicker limit is being exceeded by 27.5 per cent at the nearest distribution substation, but no complaints have been received.

This existing customer had three electric arc furnaces supplied at 22 kv. by a 4-mile line consisting of two No. 1/0 circuits in parallel (Fig. 3). The other line is much longer and connects onto other lines, all of which terminate at a stepdown transmission substation. The customer's substation is looped between two 22-kv. lines.

In 1942 one of the existing furnace transformers was replaced with a 3,000-kva. now in service. This rise in furnace transformer capacity naturally increased the flicker, and although definitely perceptible no complaints of objectionable voltage have been received.

Uses Reserve Circuit

Item F-5—An extension to an existing line was made, but transmission reserve was utilized, thus indirectly saving copper. The peacetime voltage flicker limit is being exceeded by 18.5 percent at the nearest transmission substation, but no complaints have been received.

This was an existing customer supplied from the 22-kv. system in this district (Fig. 4), but the proposed 6,000-kva. furnace was entirely too large for the present supply lines. A 4-mile, No. 4/0, 66-kv. existing line was utilized by being cut away from the present system and extended approximately 4 miles with No. 4/0 copper.

Reserves Sacrificed

Item F-7—No direct savings in copper for line extensions were made as the present 22-kv. lines were used, but an appreciable amount of transmission reserve was utilized, thus indirectly saving some copper. The peacetime voltage flicker limit is being exceeded by 18 percent at the nearest substation, but no complaints have been received.

There were no electric arc furnaces in this plant until some time in 1941, the first of two new furnaces, each powered by a 7,500-kva. transformer, was authorized and in 1942 the second duplicate furnace was installed.

This customer is supplied by three

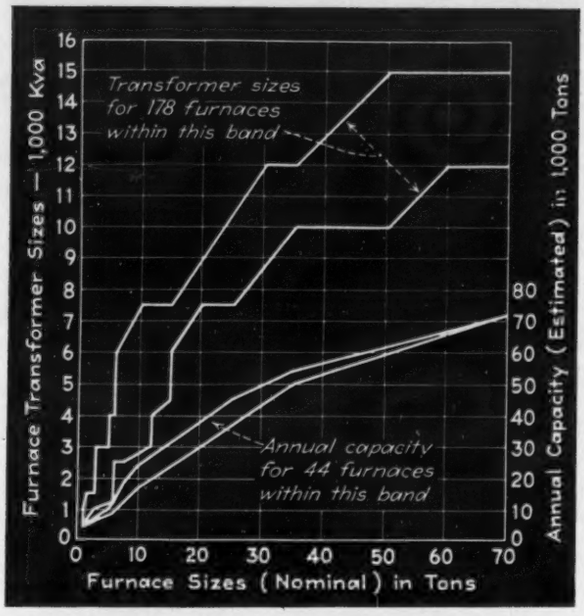

Furnace Transformer Sizes — 1,000 Kva
Annual Capacity (Estimated) in 1,000 Tons
Furnace Sizes (Nominal) in Tons
Transformer sizes for 178 furnaces within this band
Annual capacity for 44 furnaces within this band
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 10 20 30 40 50 60 70 80
0 10 20 30 40 50 60 70

FIG. 5—Transformer sizes appropriate for 178 electric arc furnaces ranging from 1 to 70 tons. Also annual capacity for 44 in the same range. (Data from *Iron & Steel Engineer*, January, 1943)

22-kv. lines (Fig. 4) essentially No. 4/0 each, and one of them can be made, by switching at the customer's plant, an exclusive isolated 4.1-mile, No. 4/0, 22-kv. line for the furnace supply only.

Three lines are looped through this customer's substation on automatic oil circuit breakers. Certain minor rearrangements in the customer's substation bus were made to permit isolating the exclusive 22-kv. furnace line. The isolating of this exclusive line is accomplished by remote control from the attended 60,000-kva. transmission substation.

When the furnaces are being supplied by the exclusive line during the meltdown period there is a very material reduction in the transmission reserve in the district, for one entire No. 4/0 line is isolated and used (only partly loaded) for the furnaces only. This naturally deprives the 22-kv. system of the *unused* capacity of this isolated line.

Peacetime voltage flicker limit is being exceeded by 18 percent without complaint.

Duquesne Light Company peacetime voltage flicker standards specify that for customers supplied at 22 kv. and 11 kv. the fluctuation caused by such customers shall not exceed 2 volts on a 115-volt lighting base measured at the nearest customer and similarly a limit of 1½ volts for customers supplied from the 66-kv. system. These values are set up for a rate of occurrence of voltage flicker of fifteen per minute to three per hour, which, we feel, will cover the fluctuation of electric arc furnaces. In some cases the limit is restricted to 1 volt for fluctuations in the range of one per second to fifteen per minute.

We have had satisfactory results from adhering to these standards in peacetime, and we expect that the knowledge acquired during the war will permit us to relax them appreciably in certain instances. Possibly some of the people noticing the flicker attribute it to mills and not factories working on war materials, and say nothing about it, but these same people might object when the war is over.

Table II—Furnace Transformer Sizes, Line Connections and Voltage Flicker Status for Various Size Furnaces from 1,000 Kva. to 10,000 Kva. in Eight Electric Arc Furnace Plants

Item Number	Figure Number	Furnace Transformers			Supply Line Data		Voltage Flicker	
		No. of Furnaces	Largest Unit-Kva.	Total Kva.	Voltage Kv.	From Separate Line or from Network	Limit Exceeded	Complaints Received
F-1	1	2	2,000	3,200	23	Network	Yes	No
F-2	2	3	3,000	6,500	23	Network	Yes	No
F-3	2	3	3,000	9,000	11.5	Separate	No	No
F-4	1	2	4,000	5,500	23	Separate	No	No
F-5	1	2	6,000	12,000	68	Separate	Yes	No
F-6	2	1	7,500	7,500	23	Separate	No	Scheduled for service in middle of 1943.
F-7	1	2	7,500	15,000	23	Network	Yes	Few at first.
F-8	2	2	10,000	20,000	68	Separate	No	Scheduled for service late in 1943.

Spare Motors for War Production Plants

Adequate provision of spare motors can result only from a thorough investigation and record of the importance of each motor in maintenance of uninterrupted production

CARROLL H. SHAW, Consulting Engineer, New York, N. Y.

ABOUT HALF of the so-called "spare" motors on hand not really needed. And the number of really needed spares about 40 percent more than were provided. That was the paradoxical situation — too many "spares" and not enough spares—reported more definitely later in this article in regard to a group of industrial plants. As a military reserve cannot be simply a rabble of men and a heterogeneous collection of materiel, but must be planned and co-ordinated in relation to the possible needs of the front line, so must the industrial reserve—spare motors, equipments and parts—be calculated and disposed for most efficient correction of failures on the production line.

Failure of power supply or of electric motors and equipment is much more important on continuous production lines than on individual machines or groups of machines. When an assembly or production line shuts down the loss of finished product and the wasted man-hours are so much more costly than providing maximum reliability of power equipment that the expense of the protection is more than justified. Where vital war goods are being made such protection is imperative.

Manners of Protection

Protection against loss of production through failure of motors may be provided by installing duplicate reserve units which can be operated alternately with the productive motors, by providing spare motors that can be used to displace defective units on short notice or by providing spare parts whose substitution for failed elements would restore the motors to operating condition. Reserve equipment includes such duplicate installations as air compressors and motor-generators whose failure for even a few seconds might interrupt plant operations. It is common practice to install reserve equipment where the failure of a single unit would have instantaneous effect upon the plant production and to carry spare equipment and spare motors where failure of an operating unit would have serious adverse effect on plant production only after a period of several hours, during which the spare unit could be substituted for the defective unit. Spare equipment should be either on hand or definitely available within a period of time that will permit of its installation without appreciable loss of plant production.

Determining Factors

Factors that will determine the necessity for spare equipment in wartime operations will have weights very different from those under peacetime competitive conditions. Under wartime conditions the decision as to the availability of spare equipment for any particular plant or operation may be made by some controlling governmental agency such as the War Production Board, while under peacetime competitive conditions it will be made by the plant management on a strictly "dollar economy" basis. In wartime operations the question of spare equipment must be considered, not in terms of dollar values, but in terms of the shortage of the particular type of equipment or of component critical materials, and the relative importance of avoidance of even a short interruption in production by the particular plant.

Most war plants are now in full production or are rapidly approaching that goal. As operations become systematized every effort will be made to increase production by eliminating bottlenecks. To do this certain items of equipment will be speeded up or replaced by others of larger capacities. While in most new plants the capacities of electric motors will be adequate for their originally scheduled output, the frequent experience that over-all plant production may be increased to 150 percent of planned output will result in overloading some of the vital productive motors, transformers, controls, etc.

Experience in studying requirements for spare electrical equipment in some important war production plants may be of value to management of other plants where studies have not been made. In some cases studies have revealed that the plant superintendents thought that spare motors were available for certain vital operations when none were on hand. The only sure way to know if spare equipment is available is to check each unit in the plant.

Productive Motor Lists

A procedure for such a check-up is outlined here.

Prepare a list of all productive

motors in the plant. It is preferable to arrange the motors on the list by the buildings in which they are installed, if the plant is a large one, with motors arranged in functional order. This will simplify the work of discussion with the operating men and will keep them from their regular work for a minimum of time. The motor list should be made on 20 column paper and should have the following headings:

1. Designation of the building by number or letter.
2. Company permanent property number.
3. Date motor was purchased.
4. Horsepower rating.
5. R.p.m. (synchronous speed is preferable for a.c.).
6. Voltage of motor—nameplate.
7. Phase.
8. Maker.
9. Serial number of maker.
10. Type of motor.
11. Frame number or designation.
12. Style of motor (if any).
13. Driven unit.

The remaining columns are to be used for inserting data that are developed by the study:

14. Is spare motor on hand?
15. Spare motor identification.
16. Is spare motor required?
17. Are spare parts only required?
18. Are spare parts on hand or on order?
19. Check-off against available spare motor list.

Spare Motor Lists

Prepare another list showing all spare motors, including those on order as well as those on hand. Since spare motors presumably are selected to fit specific installations. it is not necessary to list all of the data shown for the productive list. The column headings for the spare motor list provide for the following information:

21. Company permanent property number.
22. Date motor was purchased.
23. Horsepower rating.
24. R.p.m. (synchronous).
25. Voltage of motor—nameplate.
26. Phase.
27. Maker.
28. Type.
29. Frame.
30. Identity number of spare.

Additional columns will be used for recording the applicability of the motor. If the plant is a very large one, or if two or more plants arrange to pool their spare motors, a separate column should be provided for each plant or division. Four columns should be provided at the right of the page for the following:

W. Total number of productive motors protected by each spare.
X. Are duplicate spares OK?
Y. Need for this spare doubtful.
Z. Unneeded duplicate spare.

The two motor lists—productive and spare—should be prepared with at least six copies, five for working purposes and one for reference.

It may take several men several days to prepare these motor lists, particularly if all of the data are not immediately available. Field checks will probably have to be made in some cases. When the lists have been completed and distributed to the interested people a conference should be called to review the operation of each motor on the productive list, item by item. As final decisions should be made at the conference it is important that the men authorized to make the decision attend. In order that full information shall be available during the discussions the following men should be present with their notes and operating records:

A. Production superintendent.
B. Electrical superintendent.
C. Electrical maintenance foreman.
D. Engineer or clerk who was responsible for the preparation of the motor lists.

Discussion of Requirements

If it is expected that a considerable number of new motors will be required to build up the spare motor stock it would be desirable to have a representative of the War Production Board present. While there is no definite set-up by the board for such work, it seems unlikely that the Regional Office would not be anxious to co-operate in such an important undertaking. One reason for having a WPB representative attend the meetings and enter into the discussion is that such an arrangement would greatly simplify the succeeding steps:

1. It would avoid the necessity of recording all details of each case where a new motor is required.
2. Under the sponsorship of the WPB representative it should be easier to obtain the necessary priority rating.
3. Where a second-hand motor would be suitable, WPB can assist in locating the unit, and if a new motor must be ordered, the WPB can supply information as to the prospects of delivery from all motor manufacturers.

If there are very large motors in the plant, say over 250 hp., which are vital to plant production, it may be desirable to have the WPB a party to the understanding that spare motors cannot be carried for these units, but that spare parts, such as coils, brushes and holders, must be accepted as the only reasonable protection against extended shutdown due to motor failure.

The program can be restricted to a very rigorous formula. Taking each motor in its turn, the chairman should inquire as follows:

Is there a spare motor on hand for this motor, and if so, what is its identity number?

The reply should be checked in columns Nos. 14 and 15 of the productive list.

Is a spare motor desirable (regardless of whether one is on hand or not)?

In order to make the situation clear a second question may be asked before the first one has been answered, as follows:

What loss in plant product per hour will result from the failure of this motor and how soon after failure will the loss begin?

This last question is the key to the problem and the production superintendent should be prepared to give an accurate estimate. Experience shows that unless there has been some advance preparation of the data, there will be some uncertainty in the replies, and it is important that the answers be correct. There are three classifications of the answer to the key question, namely:

1. No loss of plant production, no matter how long the motor is out.
2. Loss of production, beginning after a definite number of hours.
3. Immediate loss, continuing until operation is restored.

Spares are Needed

Where there is no loss of plant production resulting from motor failure, no spare motor is justified, except for special conditions. If spare motors are on hand in this group and they do not serve for spares for motors in the other groups, the spare should be rated as "unneeded" and its disposal placed in the hands of WPB and other agencies interested in the use of second-hand equipment. This will help clear up stale stocks, which are often accumulations of abandoned types and sizes, and will permit new motors to be acquired after the war when definite requirements under peacetime production schedules can be determined.

Where some loss in plant production will occur after a determinable period because of failure of a motor a spare should be provided. The spare unit need not be identical with

e productive motor, but its characteristics must be equal to and may e superior—but seldom inferior—to those of the original motor.

Vital Equipment

Where loss of plant production will ccur immediately upon failure of a otor, an installation of reserve otors and perhaps of associated quipment should be made, except in pecial cases. Such reserve units are sually provided for vital elements ke air compressors, motor-generator xciters, car pullers, cranes and simir items as part of the original conruction, but if they have been omitd they should be installed where eeded.

Upon completion of the motor surey it is desirable to check up on ree features, namely:

1. Is any one motor assigned as a spare too large a number of productive motors, nd if so, how many duplicate spares hould be provided?
2. Can the number of spare motors be educed by assigning as spare another spare f slightly different, yet usable, characristics?
3. In case large motors are required as pares, particularly for single installations, may be advisable to change the proctive motor to bring it under the protion of an available spare of another ze, type or speed.

"Spares" and Spares

Experience in new war production lants and in older plants working on war program indicates that about ne-half of the spare motors on hand ill not be required under the proram outlined above, and that from 5 to 40 percent additional new spare otors will have to be secured to comete the degree of protection that will ave to be established. In one large roup of plants it was found that ere were more than 4,000 productive motors for which more than 200 pares were on hand. The survey reealed that only 109 of these spares ere needed under wartime conditions, and that more than 40 new otors would be required to comete the spare motor list.

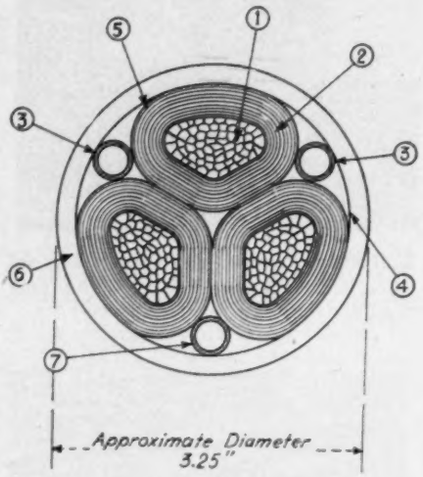
All of this relates to wartime conitions. Under peacetime conditions, hen war production is not paramount, the question of dependability f electric equipment and the value uninterrupted plant production beomes much more complex. But all mputations for both wartime and eacetime must be based upon the ta that have been outlined here.

One Gas-Filled Cable Instead of Two "Solid"

Doubled conductor cross-section and higher voltage rating of gas-filled coble allow practically twice the usual load capacity in a single duct

F. W. SMITH, General Engineer, Virginia Electric & Power Company

WAR CONDITIONS made it necessary for the Virginia Electric & Power Company to expand its distribution facilities in the Hampton Roads area served by the company. Power requirements at one location had increased several hundred percent since the beginning of the European struggle. To serve this customer two runs of 38-kv. underground cable finally became necessary and in these is clearly presented an interesting picture of how changes in the art of cable design and manufacture meet ever-changing operating conditions.



CROSS-SECTION of gas-filled cable

(1) 600,000-circ.mil compact sector conductor. (2) Impregnated paper insulation. (3) Helical tube. (4) Bronze binder tape intercalated with manila paper. (5) Perforated shield intercalated with manila paper. (6) Copper-bearing lead sheath, (7) Solid wall tube.

In 1940 the first of the two circuits, partly underground and partly overhead, was constructed to supply additional power to this customer. A 4-in. duct was available and the largest solid type cable that could be pulled into this duct was considered ample. The cable specifications are 300,000-circ.mil compact sector conductors, each insulated with 0.437-in. wood pulp paper, type H, with 0.156-in. lead, outside diameter about 3.26 in.

Added Power Requirements

Early in 1942 the second circuit, having 50 percent greater capacity than the first, became necessary because of a further increase in power requirements and to relay the first circuit to a certain extent. Again a 4-in. duct was available. It was found that a gas-filled cable provided ample capacity and it was decided to install one gas-filled cable rather than two of the solid type, in order to save critical materials, labor and cost.

Limit on the size of the gas-filled cable was the outside diameter. The cable selected is a low-pressure, gas-filled type and consists of three 600,000-circ.mil compact sector conductors, each insulated with 0.330-in. wood pulp paper, type H with 0.141-in. copper-bearing lead sheath. Two of the gas channels in the interstices are helical bronze tubes 0.375 in. OD by 0.3208 in. ID, while the third is a solid walled copper tube 0.375 in. OD by 0.305 ID. This cable has an outside diameter of approximately 3.25 in. and is rated 38 kv.

In comparison of current capaci-

ties the first (solid) cable can carry 208 amp., while the second (gas-filled) cable has a capacity of 304 amp.

The cable is equipped with phasing type spreaders and single-conductor gas-filled terminals of the "Solder Seal" type with lightning arresters at each end. These are rated 46 kv. Cable operates at 38 kv. or slightly less.

Jointing

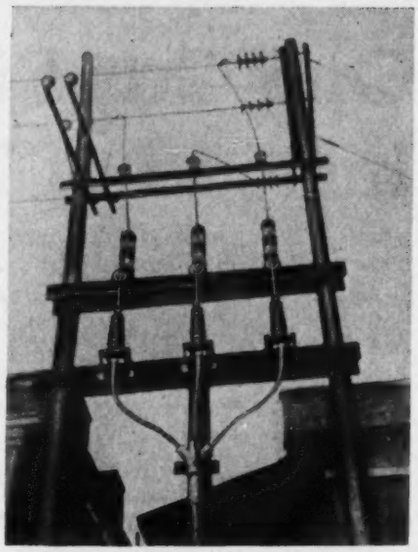
Cable joints were very carefully made in accordance with details furnished by the manufacturer. At each joint the solid tube from each direction was brought out of the cable to a T connection at the joint. This gives assurance that the same gas pressure is kept at each joint at all times and also allows testing for pressure in both directions. The lead sleeves were reinforced with three layers of duck tape applied half lapped and with a coat of asphalt compound over the sleeve and each layer of tape.

Gas-filled cable was shipped full of oil-pumped dry nitrogen gas at an average pressure of 10 lb. and equipped with pulling eyes and Schrader valves to admit gas. When received and during installation each cable length held the gas pressure remarkably well, and never was there an instance in which it had to be raised.

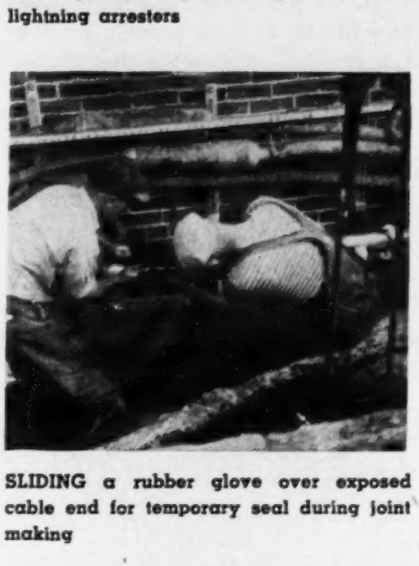
No difficulty of any importance was experienced during installation of the cable.

An interesting kink was worked out during the joint assembling for the stopping of gas flow after the cable sheath was cut. The first plan was to use a rubber sponge fastened over the end of the cable, but it was found that the sponge leaked gas at a prohibitive rate. The manufacturer's observer engineer thought of using an old rubber glove and it was found that this worked very well. The whole glove can be used to seal the cable crotch by cutting off four finger tips to allow the cable conductors and tube to pass through.

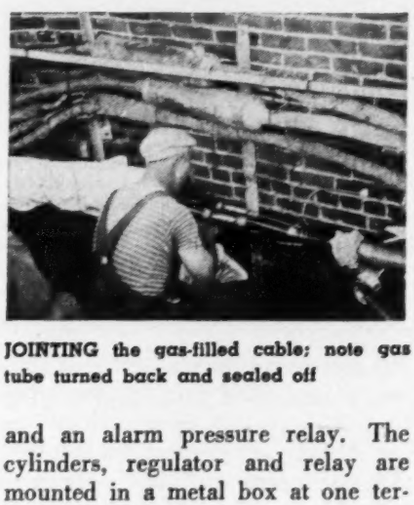
Important auxiliaries used with this cable consist of two cylinders of oil-pumped dry nitrogen gas (one is spare for immediate emergency use), two-stage nitrogen gas regulator equipped with 0-3,000-lb. cylinder and 0-30-lb. feed pressure gauges,



CABLE TERMINAL on wood pole structure, showing cable spreader, potheads and lightning arresters



SLIDING a rubber glove over exposed cable end for temporary seal during joint making



JOINTING the gas-filled cable; note gas tube turned back and sealed off

and an alarm pressure relay. The cylinders, regulator and relay are mounted in a metal box at one terminal of the cable.

From the alarm pressure relay a circuit (normally closed) runs to the switchboard in the power station for purpose of giving an alarm in case the gas pressure falls below or rises above predetermined figures.

Cable will operate at approximately 12 lb. average pressure. The gas regulator is set at 9 lb. and, therefore, the cylinder will feed gas into the cable system only when the pressure within the cable drops to this value. Pressure relay is permanently connected to the cable and its minimum pressure setting is adjusted to give an alarm before the pressure drops to 9 lb. After installation the complete system was tested at 20 lb. pressure for 24 hours and was found tight. The cable has been in satisfactory operation since July 3, 1943.

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Emergency Entrance to Storeroom

Sometimes in working on trouble at night or other times when the storeroom is normally closed it is necessary for linemen to enter and get materials or tools. Either the storekeeper must be routed out to unlock the place or line foremen must carry keys.

Both are unsatisfactory arrangements. In the one case time may be lost in waiting for the storekeeper and in the other responsibility for the storeroom is divided.

This problem is neatly and simply solved in the storeroom of the Virginia Public Service Company at Charlottesville. Two line crews work out from there. On each side of the outside entrance into which the line trucks can back and to which the crew foremen have keys are platforms, one for each crew. Here are kept supplies and equipments easily reachable when needed and which are not necessary to be carried on the trucks at all times. Beyond the platforms is the door of the storeroom, locked when the storekeeper is not on duty. On that door is a small glass-fronted box containing a key to the storeroom. If a lineman has to get in in a hurry, can't wait for the storekeeper to arrive, he breaks the glass and uses the key. The fact that he has to break the glass to get the key impresses on the man his responsibility in opening the storeroom, for he knows he will have to report the circumstances later.

A Boiler Maintenance Program for Wartime

Practical discussion of ways and means of reducing wartime maintenance of steam-generating equipment and accessories—Common troubles identified and corrective methods suggested

A. C. FOSTER, Manager Service Department, Foster-Wheeler Company, New York City*

THESE are, indeed, dire times for the plant operator whose production, due to the war, is on a 24-hour-a-day-basis with no extra boilers to carry the load. Production must be maintained, but where is the time for maintenance to come from? More maintenance must be expected when equipment is kept operating at high rates for long periods than when operated at lighter loads less continuously. Time out for repairs is an absolute necessity and must be arranged for, even at the cost of a temporary reduction in production.

Nine times out of ten it will be found that production will not suffer at all, because the higher output will be possible with ease once the equipment has been put back in first-class condition.

First Step

First step in organizing a program of preventive maintenance is for operation and maintenance supervisors to map out a joint program designed to discover where the bottlenecks are which reduce potential capacity, or efficiency, and increase the item of maintenance.

Best way to start is to make a performance test at maximum output, record all the data necessary to determine temperature drops and draft losses across the various heating surfaces, pressure losses, gas weights, quantity of fuel burned, and the efficiency. Study should then indicate where the major returns may be expected. The manufacturer may be called upon to advise in the method of making the test and to co-operate in the analysis of the data obtained.

The following are suggested methods for checking the performance of each individual part of the steam-generating unit, together with suggestions for reducing maintenance and increasing capacity. They apply directly to an average size pulverized-fuel-fired steam generator, but are also applicable to any size of unit with any type of firing.

Furnace

Generally, little furnace maintenance is necessary in the completely water- or steam-cooled furnace. However, on furnaces containing appreciable amounts of exposed refractory, furnace maintenance may be one of the major repairs. Impingement of flame on furnace walls, whether they be refractory or water-cooled, is to be avoided. Even furnace tubes of units having the most excellent condensate feed can fail due to internal deposits of scale and organic matter that form at regions subjected to flame impingement.

Observations should be made of flame disposition in the furnace and the distribution of coal between burners. Coal distribution may be checked (1) visually; (2) by carefully timed sampling in the coal conduits, and (3) by analyzing the flue gas at the boiler entrance, taking samples every foot across the width of the boiler through a water-cooled sampling tube to determine the CO_2 distribution.

Poor fuel distribution may result in localized slagging of the boiler entrance and superheater, as well as the furnace walls and ashpit, and not only result in increased maintenance but may also limit the output. Instruments which have been adjusted to indicate CO_2 at the boiler outlet may, because of serious air infiltration through the setting, result in operation with entirely too high a CO_2 in the furnace. This will be shown up by the flue gas traverse at the boiler entrance.

Furnace setting should be carefully examined, particularly the ashpit and seals between the ashpit and furnace, for air leakage. Poor combustion may be blamed on the burners, when it is actually due to their getting an inadequate supply of air with the fuel because of high furnace leakage.

Some of the leakage air enters into the combustion process; nevertheless, for a given CO_2 leaving the furnace the best burner performance will be obtained when the maximum quantity of air enters the furnace through the burners or a minimum as furnace leakage. Furthermore, air entering the furnace as leakage means that that much less air passes through the air heater. This decreases the over-all unit efficiency and more coal has to be burned. The pulverizing equipment must be operated at higher output and its maintenance, therefore, increased.

Boiler

To estimate the boiler maintenance necessary to improve performance the average boiler exit gas temperature should be measured by making a careful traverse with a thermocouple and comparing this with what the designer expected. High exit gas temperature requires that more fuel be

* Adapted from a paper presented before the Midwest Power Conference, Chicago, April 9, 1943.

burned for a given output. Reducing the exit gas temperature will permit operation at increased output. A carefully made temperature and gas analysis traverse will show up leaky baffles, setting leaks, poor burner operation and fouled surfaces. Tubes containing internal scale should be turbined. If scale is serious, competent feedwater specialists should be retained to recommend means for scale elimination. The presence of external scale and soot indicates repairs should be made to soot blowers; perhaps additional blowers should be installed, the soot blower operating pressure increased or more frequent blowing resorted to.

It will be worth while to check the draft loss, across the boiler itself and across the individual passes. High furnace maintenance, caused by lack of fan capacity, may be materially cut down by reducing the draft loss. Particularly in older designs, restrictions may be removed without materially affecting the efficiency, enabling operation at the higher loads without excessive furnace temperature. On the other hand, baffling may be opened up at the expense of efficiency, but with a material saving in maintenance because of lower draft loss.

Of all the boiler repairs likely to be neglected, repairs to baffles probably rank at the head of the list. Leaky baffles increase fuel consumption and reduce the maximum output. If high gas velocities occur at the leaks the flyash passing through with the gas may cut through tubes, causing real trouble.

The drop in CO_2 between the boiler entrance and exit should be measured to ascertain the amount of air infiltration. This will indicate the extent to which the setting should be sealed. Generally, it is advisable to seal the setting as well as possible and check the CO_2 drop again, and to keep testing and sealing until the drop in CO_2 between boiler entrance and exit is not more than one-half of 1 percent.

Superheater

Maintenance of superheaters may amount to a considerable item on older installations being operated at higher than usual loads. First, determine the final steam temperature and the pressure drop and compare the results with the guarantee. Pressure drop will indicate whether any appreciable internal fouling due to carryover of boiler water solids may have occurred. Internal fouling may bring about failures due to overheating. Such deposits may have resulted from operation with too high boiler water concentrations, maintaining too high a water level in the drum, foaming or priming due to the presence of oil, or organic material in the boiler water, operating at loads above those for which the drum and its internals were designed, or leakage of boiler water solids past the washer and drier.

Removing Deposits

Water soluble deposits may be removed by flushing each element with warm water. When deposits are not water soluble good results have been obtained by boiling out the superheater with a 5 percent solution of 44 percent grade lactic acid in water. The elements are filled with the solution and the unit fired at a moderate rate to maintain a temperature in the superheater of about 200 deg. F. for ten or twelve hours. After this each element should be flushed out with hot, clean water for ten or fifteen minutes. The water velocity should be high enough to sweep any loose scale from the element and the flushing water should be discharged through a hose to the outside of the header in order to prevent its finding its way back into the elements which have already been flushed out.

Overheating and failure of superheater tubes may be caused by slagging of the superheater. Such slagging may indicate the necessity for more effective soot blowing, more frequent use of soot blowers, the necessity for hand-lancing, etc. When a superheater slags, gas velocity through the open passages is increased and the high transfer rates resulting may bring about failure through overheating. In some cases the external surface will be found to be covered with an adherent deposit. Sandblasting appears to be the only method that will return such elements to their original condition.

Superheater Starting

More superheaters are damaged while the unit is being placed in operation than at any other time. It is just as important to protect the superheater by having steam flowing through it when the superheater is exposed to radiant heat or hot gases as it is to have water in the boiler when it is fired. During the warming up of a cold boiler and superheater it is essential that the heat be uniformly distributed over the superheater surface. This is especially important with superheaters of the non-drainable type, in which it is necessary completely to evaporate the water that has collected by condensation during a shutdown before steam flow through the elements can be established. The section above the level of the water in those containing water may be severely overheated, even to the point of rupturing. The way to prevent such damage is to limit the firing rate, while bringing the boiler up to pressure, so that the gas temperature entering the superheater does not exceed 1,000 deg. F.

Against damage through overheating during loads and when on banked fire a safe procedure is to open the drain valves fully when the boiler is first taken off the line and close them when the furnace becomes dark.

Economizer

Economizer maintenance usually consists of cleaning the internal and external surfaces and reducing air leakage to a minimum. Inspection will indicate whether such cleaning is necessary, and measurement of the drop in CO_2 between the economizer gas inlet and outlet will tell whether the air leakage is serious. The nearer the induced draft fan or stack is approached, the greater the necessity for sealing leaks due to the greater suction prevailing in the gas ducts and the economizer itself. On economizers having low inlet water temperature—that is, below 210 deg. F.—oxygen corrosion may be the cause of considerable maintenance. The lower the temperature, the higher may be the oxygen content of the feedwater. In no case should the temperature fall below 180 deg. F. and, preferably, it should be 210 deg. F. or higher.

External corrosion and fouling are generally caused by operating with too low tube metal temperature. When this temperature falls below the dew point of the gases corrosive deposits are formed. Controlling factors in the formation of these deposits are the

emperature of the incoming feedwater, the excess air and the percentage of sulphur in the fuel being burned. With low incoming feedwater temperature the tube metal temperature in the inlet section of the economizer will be low. The higher the sulphur content, the higher the dew-point or temperature at which the deposits form.

External deposits of this type may be removed by soaking them thoroughly with water at a temperature of 150 to 180 deg. F. for a period of ten or twelve hours. Where the economizer construction does not incorporate a hopper directly below the economizer, or where the spray water will run down the gas ducts, a temporary trough should be installed directly below the bottom elements and drained through a suitable line. Directly above the top elements spray pipes or nozzles, sufficient in number, type and size to produce a soft spray of hot water falling evenly and well distributed over the economizer, should be installed. The spray should be continued for a sufficient length of time to cause the deposits to fall off. Then use a high-pressure, high-velocity jet of water working from the top down to wash off any adherent deposits. When the economizer is clean the nozzles and trough should be removed and the unit fired hard enough to provide gases above 300 deg. F., leaving the economizer to evaporate all moisture and corrosive liquids resulting from the washing.

Air Heater

Air heater maintenance usually consists of cleaning and reducing air leakage. This may require rerolling tubes and welding them, or replacing sections of plate type or regenerative type heaters. It may be desirable to wash the surfaces on the gas side to remove deposits that have accumulated over a period of years. In tubular air heaters, if too great a number of leaky tubes have been plugged, they should be replaced, when possible, with new tubes in order to reduce the draft loss. Air leakage in the air heater limits the capacity both by overloading the induced-draft fan and reducing the amount of air available to the furnace for combustion. Where capacity is being limited because of the air pressure loss through an air heater, it may be found beneficial to bypass part of the air around it.

Fans

The forced-draft fan, in general, requires little maintenance other than what might be necessary on bearings. However, the fan may not be handling the weight of air that it was expected to handle because the entering air is at higher temperature than anticipated. It may be advantageous to arrange for the fan to get cool air from outside the building rather than the hot air which it is handling.

Maintenance of the induced-draft fan will, neglecting the effect of speed, depend entirely upon the weight and particle size of the flyash which the fan must handle along with the gases. On those pulverized coal installations where no attempt is made to collect flyash before the induced-draft fan maintenance will be high and a noticeable increase in maintenance will be found necessary when high, continuous loads are carried. It is common practice to make repairs to fan rotors by welding. Such repairs should be made in a careful manner to avoid reducing fan efficiency. Determine from the manufacturer whether the fan rotor can be welded without being stress-relieved or heat-treated afterward.

Pulverizers

Capacity is not the only measure of pulverizer performance. Fineness of the pulverized coal must always be considered along with capacity, and a good measure of pulverizer performance is the pounds per hour through 200-mesh material produced. It becomes necessary to investigate the fineness in order to determine what pulverizer repairs are required. This necessitates the careful collecting of an average fineness sample in accordance with accepted methods of testing.

Poor burner performance, excessive slagging, high combustible loss and high furnace maintenance, all of which may reduce the maximum output of the steam-generating unit, may be due to coarse grinding. The combustible in the flyash is materially affected by the fineness. Freedom from slagging is also promoted by fine pulverization. Fine particles, burning faster than coarse ones, will contain less unburned carbon when they pass out of the flame into the clear gas space to give up heat by radiation to cold surrounding wall surfaces. The smaller the particle the more certain it is to be solidified throughout by the time it reaches the boiler and superheater.

Burners

Burners are another part of the installation that are apt to be neglected. Burner throats should be kept in good repair. With circular turbulent type burners, especially, poor flame shape, flame impingement on side walls, as well as excessive combustible loss and localized slagging, may result from burner throats having deteriorated from the original dimensions. Improved burner performance means added capacity and efficiency. Nozzles exposed to radiant heat, or where ignition has been maintained too close to the burner, may grow to such an extent that the velocity of the coal-air mixture leaving the nozzle is much lower than was originally intended. It then becomes impossible to maintain control of flame shape and flame travel.

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To Eliminate Accident Hazards

"Routine inspections of our entire property, consisting of about 225 locations, are conducted at least twice a year for the purpose of detecting hazardous conditions which have developed since the preceding inspection. Special inspections are made when indicated."

"New installations and changes in existing installations are discussed with the engineering department, and through these contacts many hazards are eliminated while projects are still in the design stage. These installations are followed in the field as the work progresses. We have enjoyed excellent relations with our engineering department, with the result that many costly changes in the field have been eliminated."

(Quoted from "Accident Prevention in a Public Utility" by Roy M. Godwin, Philadelphia Electric Company, in July, 1943, "Executives Service Bulletin" of Metropolitan Life Insurance Company.)

Simple Preventive Maintenance Protects Apparatus Bushings

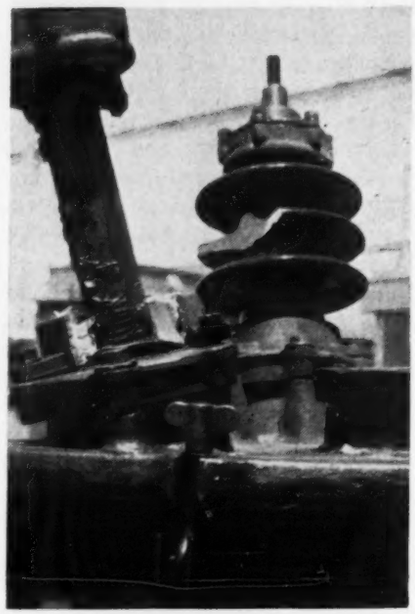
Simple change in widely used type S and SI bushings corrects tendency to inhale moisture — Salvages bushing for duration without use of critical material and at 10 percent of cost of replacement value of new bushing

L. M. LIMPUS, Superintendent of Reclamation, Oklahoma Gas & Electric Company, Oklahoma City

POWER FACTOR and visual inspections often disclose a weakness in the now-obsolete G. E. type S and type SI bushings, many thousands (possibly 250,000) of which were manufactured and used in oil-filled apparatus during the period from 1916 to 1932. By a simple preventive maintenance operation, cost of which seldom exceeds 10 percent of the replacement value of the modern type L bushing, these bushings can be rehabilitated to serve for the duration. Alterations can be made without the use of highly critical materials.

Although such a rehabilitated bushing still lacks much in mechanical and electrical comparison with its modern type L replacement, it is believed that the modifications, to be described, will extend the normal life of these bushings well into the future, or until gradual replacement of obsolete equipment can be resumed.

Most of the improvements in this bushing during its 16 years of manufacture were intended to eliminate the hazard of oil contamination in the compound space between the central insulated core and the outside porcelain weather casing. Once insulating oil, from the apparatus in which the bushing was installed, entered the compound space through the minute crevices normally existing between the solid core and metal ground sleeve hydraulic pressure sufficient to rupture the assembly gasket was often experienced, with normal changes in ambient temperature. Increasing temperature expanded the oil far more rapidly than it could be expelled back into the apparatus through the crevices which had permitted its migratory entrance.



TYPICAL FAILURE resulting from flashover underneath porcelain weather casing

Following gasket rupture, expansions led to an extrusion of oil or compound on the outside surface of the bushing. Subsequent contractions led to an inhalation of moisture and air through the restricted orifice of the rupture whenever there was any change in volume of the oil in the compound space due to normal changes in the ambient temperature. Large quantities of moisture were generally inhaled during sudden thunder showers. This moisture contamination in the compound space would, and will eventually, lead to a flashover underneath the porcelain weather casing. Fortunately such contamination is readily discovered by test, using any of the several power-factor or dissipation-factor-testing devices, or by observation, whenever an oil or oil-compound extrusion is manifest.

Some variations of the General Electric Company's recommended repair methods, as detailed in its bulletin GEI-9186-B, have been published* as a means of simple rehabilitation. Most of these endeavor to seal the compound space against both moisture and oil, but our experience over a period of several years indicates that perhaps none of these methods will prove wholly satisfactory.

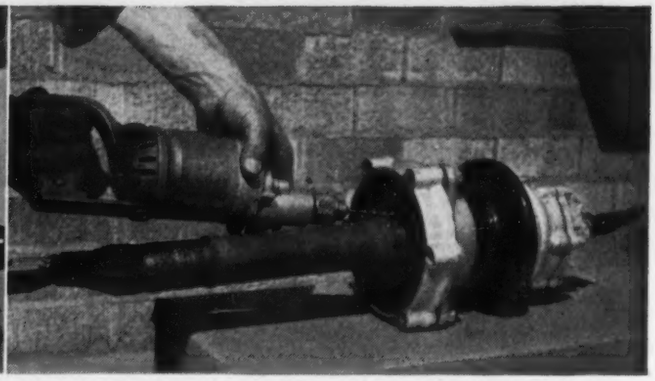
Prior to the fall of 1941 it was our standard practice to replace these bushings with type L bushings whenever they were discovered in a deteriorated state. With the bombing of Pearl Harbor it became evident that type L replacements were destined to become a highly critical item. Accordingly several possible repair methods were investigated. Since it appeared that the principal weakness of these bushings was the compound space seal, it was decided to open this space and permit it to breathe into the interior of the apparatus. To date, this operation has proved simple and successful.

Barrier Perforated

In those cases wherein the bushing is constructed with a tubular metallic conductor and a power factor test or a very close inspection of the assembly gaskets does not disclose the possibility of a hazardous moisture condition, the upper terminal cap is removed and the two compound space filling plugs taken out; one is shown removed in an accompanying illus-

*"Electrical World," Jan. 9, 1943, page 7

ETAPING bushing core; renewing tape over etal ground shield



PERFORATING the barrier between transformer and bushing compound space on the high-current bushing

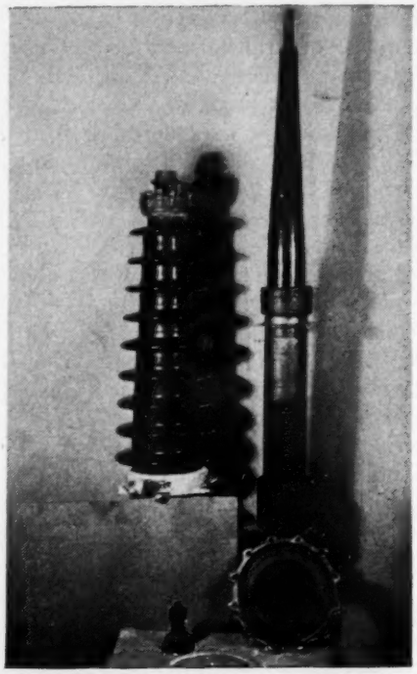
ation. It is important that the terinal cap be carefully replaced, using ly the special G. E. synthetic rubr terminal cap gasket No. 390239 T-21E, so that a permanent oil-tight, eatherproof seal is accomplished. he compound space is now free to eathe into the interior of the appatus, where little, if any, moisture present.

When the power-factor test or visl inspection discloses that a gasket s already faulted, the bushing ould be taken out of service, transrted to the repair shop and the eather casing and old compound reoved. Detailed instructions for dissembly and reassembly are conined in the G.E. instructions No. I-9186-B. Without disturbing the innings and ground sleeve on the wer portion of the core, the upper e portion of the bushing core is aped clean to remove all of the varnish. The core is then placed in suitable atmospheric-pressure or all vacuum oven for drying. When wer-factor testing equipment is not ilable for the determination of yness, the bushing core should be in the atmospheric oven at 100 g. C., or in the vacuum oven at deg. C., for at least ten days.

Revarnishing Important

Immediately upon removal from oven the core should be revarhed while hot, using any good h-grade, oil-proof, weatherproof nish having a very good dielectric aracteristic. If necessary, the lower rtion of the core should be retaped l varnished, but no attempt to reild the ground sleeve is required less it has definitely faulted. The ather casing should be reassembled l new oil-proof compound used in accordance with the manufacturer's instructions, except that the compound space-filling plugs are greased for easy removal when the bushing is returned to service. When these rehabilitated bushings are held as spares an added precaution against moisture contamination may include the assembly of a terminal cap on the upper end and a cork plug inserted in the bottom opening of the tube.

In those cases where the bushing is constructed with a solid conductor no field operations are attempted. As soon as the bushing shows signs of distress it is removed to the repair shop, disassembled and several small holes drilled, as shown, through the upper spinning, which forms a barrier between the compound space and the interior of the apparatus in which the bushing is installed. Upon reassembly the compound is left out, which permits the compound space to breathe into the apparatus and fill with oil through the drilled holes when installed on conservator-equipped transformers. After installation in such equipment the compound-filling plugs are loosened to permit the entrapped air to escape. It should be noted, however, that whenever it is necessary to again lower the oil in the main transformer tank the oil may run out of the bushing and it will again be necessary to release the entrapped air when the tank is refilled.



BUSHING dismantled for rehabilitation

VIEW of upper terminal assembly with one of the compound-filling plugs removed

Better Maintenance Betters Transformer Performance

Record of fifteen years shows that improved operational methods are largest factor in reducing transformer troubles — Age appears to be of small moment

SIGNIFICANT reductions in numbers per year of transformers in trouble, of transformers out of service for repairs and of bushing failures, accompanied by a lowering of unit repair cost, are disclosed by the summary record of transformer experience shown here. These records are evidence of the improvements in transformer design, in means of transformer protection and in methods of transformer inspection and maintenance that have been made in recent years.

Compilation of the record began in 1928 and has continued without interruption up to the present. The purpose of the record was and still is to furnish the management of the utility from whom the data were obtained with comparative figures of performance and cost on different makes of transformers to be used as a guide in purchasing. The published summaries do not disclose any comparisons between makes, but they do illuminate the advances made over a period of years in transformers and in the operational practices affecting them.

Improvements in transformer design have contributed substantially to the betterment of performance shown by the record. Study by transformer designers of the internal characteristics of transformer coils resulted in more definite knowledge of proportioning of insulation between turns and of configuration of coils which, when applied in design, produced coils with more nearly uniform distribution of capacitance and thus eliminated many points of possible breakdown. Adoption of conservator tanks, use of inert gases to inhibit oxidation and more adequate provision of flow channels through core and coils resulted in lessened deterioration of transformer oil and in more effective performance of its function of cooling.

Paralleling improvements in transformer design, and like them deriving principally from greatly extended knowledge of lightning were advances in the art of electricity transmission which contributed largely to betterment of transformer performance. New inventions in lightning arresters and other protective devices, more effective applications of static wires and counterpoises, more highly developed discrimination in relay functioning, all the new things and ideas in transmission resulted also in better performance of transformers.

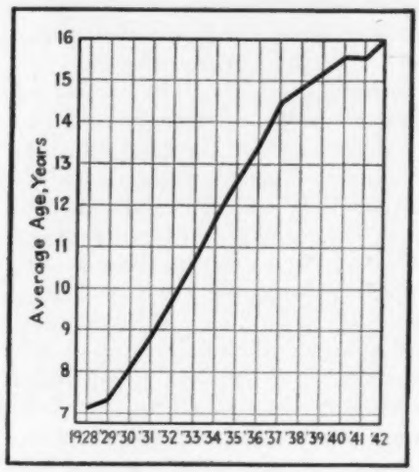


FIG. 1—Average ages of transformers in service, 1928-1942

On the strictly operational side were the closer attention paid to transformer loadings and other conditions of operation. More frequent checking of oil and copper temperatures and of dielectric strength of oil, of insulation between coils and to ground and of bushings disclosed weaknesses and competent maintenance corrected them in their incipient stages.

The record does not cover distribution transformers, but only the so-called "power" class. Sizes range from 100 to 25,000 kva.; the average size for the 2,331 transformers in service at the end of 1942 is 1,288 kva. At that time the distribution according to voltage classes was as shown in Table II. The largest number is that of the 44-kv. class, nearly half of the total. Next largest, over one-fourth of the total, is the 13.2-kv. class.

Average Age

Testimony to the inherent longevity of transformers is plain in the third column of Table I, showing average ages of transformers in service at the end of 1942. The age as shown represents the actual time the transformer has been in service and not the elapsed time between date of purchase and present date. Table III gives the numbers purchased previous to 1910, in five-year periods to 1940 and in the two years to the end of 1942. About 5 percent of the transformers are over 32 years old, 12 percent over 27 years, 27 percent over 22 years, 42 percent over 17 years and 73 percent over 12 years.

Table III shows another thing that is notable, although not in reference to transformer performance. The 720 transformers installed in the five years 1925-1930 are practically equal in number to those installed in the previous ten years and are 87 more than those installed in the twelve succeeding years. The unfortunate fact of the slowing up of electri

Table I—Summary of Transformer Troubles and Repair Costs

End of Year	Transformers in Service	Total Kva. in Service	Average Age of Transformers	Kva.-Years in Service	Total of All Troubles	Core or Coil Failures	Cores or Coils Out for Repair or Replacement	Kva. Capacity Out for Repair	Misc. Failures	Bushings in Service	Bushing Failures	Total Cost of Repairs Maintenance and Repair Cost
1942	2331	2,902,230	16.0	46,483,311	52	14	14	6,110	10	9,324	33	$73,385.16
1941	2266	2,776,219	15.52	42,942,857	71	28	37	21,752	8	9,064	48	95,018.53
1940	2208	2,622,869	15.55	40,723,724	53	12	18	42,828	6	8,832	42	90,608.24
1939	2184	2,504,869	15.2	38,174,618	84	24	28	19,400	11	8,736	67	84,885.54
1938	2131	2,546,607	14.8	36,226,513	56	13	18	25,023	13	8,512	37	81,154.73
1937	2120	2,367,262	14.45	34,236,076	91	37	44	37,500	10	8,480	58	81,213.14
1936	2083	2,313,584	13.44	31,097,121	99	35	35	27,434	17	8,332	66	45,582.38
1935	2057	2,287,059	12.65	28,924,785	56	16	16	12,275	4	8,228	51	43,177.98
1934	1581	2,092,226	11.74	24,569,136	99	25	25	31,075	6	6,390	68	38,912.15
1933	1582	2,095,801	10.67	22,351,801	68	19	19	5,666	5	6,414	44	32,509.40
1932	1562	2,084,101	9.72	20,252,509	72	16	16	5,463	11	6,328	45	33,985.41
1931	1572	2,089,601	8.85	18,532,713	107	25	25	37,065	16	6,366	66	55,947.02
1930	1565	2,078,918	8.05	16,669,929	120	30	30	16,375	15	6,332	79	75,847.77
1929	1530	1,996,013	7.35	14,691,474	193	59	59	50,125	18	6,204	116	78,210.90
1928	1627	1,905,372	7.11	13,293,589	171	41	41	29,550	31	6,577	99	46,823.94
Averages...	1893	2,304,849			93	26	28	24,510	11	7,608	61	

utility expansion in the past ten years finds corroboration here, if any is needed.

The oldest transformer in service at the end of 1942 was purchased in 1907. That transformer and others purchased in the same year and in years up to 1913, probably about 180 altogether, are already well past the 30-year mark, the age which is generally regarded as "threescore and ten" for a transformer. Apparently these ancient transformers are as good as ever; as will be shown later in discussion of troubles, there is nothing in the record to indicate that they are any more susceptible to trouble than those of later purchase.

The curve of Fig. 1 includes only two years of the decade when rate of transformer purchasing was at its highest point. But the effect of these purchases can be seen in the comparative flatness between 1928 and 1929. Then purchases fell off in the following eight years, as indicated by the accelerated rise of the curve. The flat section, 1940-1941, is caused by two factors, one being the acquisition of new transformers and the other the removal from service of several banks of transformers with a large accumulation of kva.-years for relocation at other points.

Transformer Troubles

Examination of the columns of transformer troubles in Tables I and IV does not indicate that age is an important, or any, determinant of them. The column of percent of transformers in trouble in Table IV shows a fast decline from the early years of the record. It might be considered that this decline results to considerable extent from the addition of new and better transformers in recent years, but this idea is not supported in fact. According to Table III only one-fifth of the total number of transformers were installed since 1930 and an addition so comparatively small could not cause the percent of troubles to drop in the same period from 7.69 to 2.23 nor the actual number to fall from 120 to 52.

The figures show rather that the older transformers suffered fewer troubles in the later than in the earlier years of the record. This is not to say that transformers, like wines, improve with age. It merely says that improved protection against lightning and other hazards, more frequent inspection and test, closer attention to loading and all 'round better maintenance are much more important than age as factors in the equation of transformer service-years.

Further evidence of the effectiveness of improved protective and operational practice is shown by the graphs of Fig. 2. Allowing for the variation from year to year in incidence of weather phenomena, it is seen that a rapid decline in number of transformers in trouble occurred in the first seven years of the fourteen-year record. In the second half of the period the decline was slower. The curve of transformers suffering coil or core failures is much flatter than that of total troubles, but except for the years 1933 and 1937 the values of the two curves maintain relative proportions that, while scattered over a considerable range, do result in a ratio curve whose average line is pretty close to the horizontal, as appears at the top of Fig. 2.

Table II—Transformers by Voltage Classes—1942

Voltage-Kv.	Number	Kva.	Average Kva.
13.2	625	289,420	463
22	165	44,211	268
33	96	57,850	63
44	1,121	779,705	696
88	324	1,731,044	5,343
Totals.....	2,331	2,902,230	1,288

Table III—Years of Purchase of Transformers in Use at End of 1942

Period*	Number	Percent	Accumulated Percent
Up to 1911.....	113	4.84	4.84
1911–1915.....	115	6.46	11.30
1916–1920.....	358	15.32	26.62
1921–1925.....	356	15.23	41.85
1926–1930.....	720	30.75	72.60
1931–1935.....	132	5.65	78.25
1923–1940.....	292	12.48	90.73
1941–1942.....	209	9.27	100.00
Totals.....	2,331	100.00	

*Periods are inclusive.

The level of extremely low figures in Table IV of percentages of kva. capacity out for repairs in 1932 and 1933, 0.26 and 0.27 respectively, was not reached again until 1942. But the 1942 figure of 0.21 percent has not the same explanation as those of 1932 and 1933. It may be assumed confidently that in those years—the valley years of the business depression—the occasions for repairs were

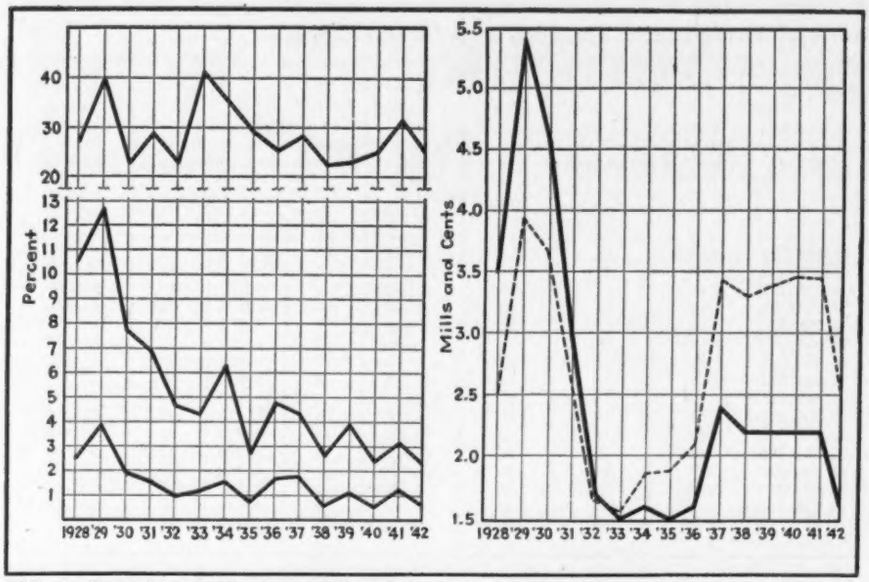


FIG. 2—Record over 15 years of transformers in trouble; upper curve shows ratios of coil or core failures to total troubles, middle curve shows transformers in trouble and bottom one coil or coil failures, both in percentages of total numbers of transformers in service. FIG. 3 (right)—Repair costs; solid line shows mills per kva.-year and broken line cents per kva.

few because there was little pressing need for transformer capacity. However, in 1942 the picture was different. Every kva. of capacity was needed and the low figure of 0.21 percent of transformer kva. out for repair was plainly the result of greatly improved protective and operating methods.

Costs of repairs on unit bases cannot have great validity as measures of transformer performance because of the inclusion in them of the extraneous variables of labor and materials costs. However they do have certain indicative value, as is shown by the curves of Fig. 3. The contours of the curves of repair cost per kva. and per kva.-year are roughly the same.

In this graph there is to be seen again the evidence of good performance of the old transformer that is properly protected and maintained. Given the conditions of constant costs for labor and materials and constant ratio of troubles per kva., the cost of repairs per kva. would be a straight horizontal line. (It is curiously the case that the broken line curve of Fig. 3 can be averaged out practically to such a line.) On the other hand, with the same given conditions, the curve of repair costs per kva.-year should be a downward sloping line because of the increasing average age of the transformers. This trend is actually to be seen in the curve of cost per kva.-year and it must be accepted as indicating satisfactory performance of the older transformers.

In regard to both graphs of Fig. 3 it must be accepted that the deep valleys between the points of 1930 and 1937 represent the business conditions of the intervening years. The significance of the graphs for these years lies rather in their mutually comparative, not in their absolute, point values. This is to say that had it not been for the business depression there probably would have been no valleys in the two graphs and they would more closely follow their logical trends—a horizontal development for the line of cents per kva. and a decline for cents per kva.-year.

Bushing Failures

As noted in Table IV, the record of bushing failures may be looked at in three periods of successive years, 1928-1931, inclusive, no testing; 1932-1937, inclusive, sporadic testing; 1938-1942, inclusive, routine testing. In the earliest period the average percentage of failures was 1.42. No testing was done in those years. Testing of suspected bushings was begun in 1932 and tests became more frequent and more revealing as test methods and devices improved in the years of the middle period when the average percentage of failures dropped to 0.76. Then in 1938 came the adoption of regularly scheduled tests employing well-established techniques and equipments, with the result that the average percentage of failures went down to 0.51.

Comparisons of rates of bushing failures between years have no meaning in terms of the summary data here presented because the record includes nothing on lightning occurrence. But by grouping the years into periods the variable factor of lightning may be presumed to be canceled out, at least to some significant degree. Thus it may be stated that the decline in average percentages for the three periods is actually a measure of the effectiveness of improvement in practices of testing.

Table IV—Percentages of Troubles and Failures and Unit Costs of Repairs (Cents)

Year	Transformers in Trouble	Core or Coil Failures	Transformers Out for Repairs*	Kva. Capac. Out for Repair	Repair Cost per Kva. Cents	Repair Cost per Kva.-Year, Cents	Bushing Failures
1942	2.23	0.60	0.60	0.21	2.52	0.16	0.35
1941	3.14	1.29	1.64	0.79	3.44	0.22	0.53
1940	2.40	0.54	0.82	1.63	3.46	0.22	0.48
1939	3.84	1.10	1.28	0.78	3.39	0.22	0.77
1938	2.63	0.61	0.85	1.02	3.30	0.22	†0.44
1937	4.28	1.75	2.08	1.59	3.43	0.24	0.69
1936	4.76	1.68	1.68	1.19	2.10	0.16	0.79
1935	2.73	0.78	0.78	0.54	1.89	0.15	0.62
1934	6.26	1.58	1.58	1.49	1.86	0.16	1.06
1933	4.29	1.20	1.20	0.27	1.55	0.15	0.69
1932	4.62	1.03	1.03	0.26	1.62	0.17	†0.71
1931	6.82	1.59	1.59	1.76	2.67	0.30	1.04
1930	7.69	1.94	1.94	0.79	3.68	0.46	1.25
1929	12.61	3.85	3.85	2.51	3.93	0.54	1.87
1928	10.50	2.53	2.53	1.53	2.50	0.35	1.51

† In 1938 routine periodic testing of all bushings was begun following five years of testing suspected bushings only.

* Differences between "coil or core failures" and "transformers out for repair" in the years 1936 and after are largely explained as rebuilding jobs for increases in capacity or change in voltage.

Wood-Stave Pipe Line Repair Methods

Rebuilding of 6-mile line discontinued due to wartime conditions — Serviced by three-man crew — Quantities of steel patching plates prepared

THREE MEN are kept busy continuously repairing breaks like this or worse

THE Eastern Oregon Light & Power Company, Baker, Ore., has 6 miles of pipe line from Olive Lake to the Freemont 1,100-kva. hydro plant. It is mostly wood stave, 33½ in. in diameter at the upper end and 23½ in. at the lower end, with 4¼-in. staves of creosote-treated coast fir and round, 7/16-in. bands. This was originally constructed in 1907 for a mining property and bought by the power company in 1914. In it are two small sections of comparatively new pipe, which were installed four years ago, at which time the company started to rebuild the line. Owing to the war, this work had to be abandoned. So now it is necessary to carry on a continuous routine of patrol and repairs, started in July, 1940, in order to keep the 35-year-old pipe line in operation.

Three-Man Crew

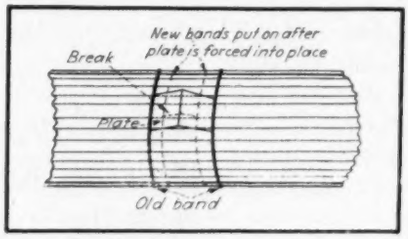
A crew of three men is kept on the job continuously. One man patrols the entire line once a week and then puts in all the rest of his time patching, along with the two others. In the matter of blowouts and slow leaks, the ancient line can run circles around any old tire, especially since, at the lower end, the pressure reaches 280 psi.

The bands seem to hold fairly well, but the wood is rotting, blowing out in most instances at the seams, but in some cases small sections of stave will give way between bands and blow out. Trouble seems to be more prevalent in the low-pressure sections of the pipe than in the high-pressure. The reason is that under higher pressure the water penetrates the wood more and keeps it constantly wet, slowing up decay.

In stopping a leak, which in most cases appears between only two adjacent bands, the procedure is first to dig the dirt away from the pipe and make a drain to carry off the water while the men are working. In the winter time this is not so easy for a series of small icebergs must first be cleared away.

Next, a steel plate is driven in place over the break. These plates have been fashioned beforehand in quantities and of various sizes to fit under the different spacings of the bands. In the low-pressure sections the bands are 6 to 8 in. apart, but in the highest pressure sections they are almost touching each other.

The patching plates are of 16-gauge steel and they are slightly curved or humped in the middle, as shown in the sketch. Burlap or canvas is placed on the concave side of the plate and it is forced down over the break with its edges directed under the old bands. It is then driven down with a heavy hammer, the edges cutting into the wood under the bands, until the whole surface is down to the stave, with the burlap between. Before it is completely seated, however, two new bands are put on over it and drawn up. With successive tightening of the new bands and pounding down of the plate a tight mend is achieved. The bands are Federal Pipe & Tank, drawn up with nuts over special shoes.



A STEEL PLATE arched up in the middle is driven under adjacent bands and pounded down flat, with burlap underneath; then two new bands are put on over it and tightened, after which the top and bottom edges of the plate are crimped into the wood; after that sedimentation does the rest

After the plate is in place and the bands drawn up, the edges under the old bands are of themselves well set in the wood. Not so the top and bottom edges parallel to the staves. These are crimped with hammer and chisel so as to drive the edges into the wood. Sediment afterward completes the sealing process.

Much of the original pipe line was buried, but a leak very soon becomes evident on the surface. As repairs are made, the pipe is left exposed at those points. In making repairs the men use miners' equipment and clothing, though in the words of L. E. Wiggans, general superintendent of substations and hydro plants, they really should be provided with divers' helmets. Under any circumstances it is a tough, uncomfortable job, doubly so in winter, with up to 72 inches of snow. To get them in and out the company purchased an Eliason toboggan, gas engine-driven.

Editorials

S. B. WILLAMS, *Editor*

Voluntary Conservation Must Go On

NOTHING is more thankless than trying to get people to do something they don't want to do. Such is the situation that exists today with respect to voluntary conservation of electricity to save coal and transportation.

The greatest savings will have to come from reduced usage by merchants and electric sign users. They are willing to turn out their lights if all the others do, but where there is lack of compliance, not only locally but elsewhere, they balk.

One cannot help being understanding of that point of view, yet one must not let one's feelings get the better of one's judgment. Conservation is necessary and the work of convincing customers of this need must go on.

It has been discouraging to see the coal miners toss away the production of some fifteen million tons in a few days of work stoppage in order to satisfy their demands. It isn't easy to ask your customers to pay you less money to help the war effort when some one else throws away many times more than you can save just so he can be paid more. Nevertheless, it must be done, because if the situation was bad two months ago it has been made worse by this fuel production loss.

Most utilities have made an honest effort to secure compliance, although a great many have underestimated the amount of effort necessary to make the program succeed. In far too many instances the management's heart was not in the job, and the employees who were contacting the commercial customers have been reflecting this attitude. Obviously, when lip service only is given the customer not only loses interest but, if there is any criticism for non-compliance, he blames the utility. This has happened in a number of cases.

Today the voluntary program is in jeopardy and, regardless of who is to blame, the censure is being and will continue to be heaped upon the electric power industry simply because it cannot hide non-compliance.

The industry has strong friends in Washington who know how much this industry has contributed to the war effort and the sacrifices it has made. Their hands will be tied, however, in any effort to give the industry an even break if any large segment of the industry falls down on this program, deliberately or otherwise.

The Cost of the Dimout

THE DIMOUT has been lifted. After a year and a half of next to darkness the public again may use the city streets in the coastal areas with a sense of security. It was a great experiment, the results of which in terms of shipping security will probably never be known. The price for the experiment in human life was tremendous. We hope it was justified.

Because all the communities do not keep complete highway accident records there is no way of telling just what the total human cost of the dimout was. However, we can get an idea from some official figures for Connecticut just released by the State Department of Motor Vehicles.

A comparison of the first six months of this year with the first six months of last year on the basis of vehicle-miles showed an increase in night-driving accidents of 52 percent, fatalities 43 percent and cost 43 percent. The record for city streets was much worse than for rural areas.

New York City, according to data released from time to time, shows up worse than Connecticut. What the record is for the rest of the coastal regions is not known, but it is plainly evident that it is enormous.

On cost alone Connecticut reports $3,693 per hundred million vehicle-miles as the price of night accidents in 1943; last year the cost was $2,582. The increase of 43 percent meant that Connecticut paid out an increased cost for its night-driving accidents during the first six months of 1943 close to $150,000.

While the dimout has been an expensive lesson in human loss and in cost, it should be of great public service in the future because it has demonstrated as nothing else could the effectiveness of light in reducing the night hazards on the streets. Carefully compiled figures such as these indicate that good street lighting does not cost money—it saves money.

Which War Expedients Will Be Kept?

FROM TIME TO TIME we hear people say that not all of the practices born of war emergency will be discontinued as soon as materials and equipment are again freely available. As a general statement that is undoubtedly correct, but when one begins to particularize the hedging starts.

How does one go about finding out which of these emergency practices and methods should be kept and

which discarded? Has any procedure been set up by which they can be weighed? In fact, how many companies are keeping a record of their war-born expedients?

In some instances, reserves in generating capacity and in lines were drastically cut during the war. In a great many cases the cut was probably too great for normal operations. Has our war experience given us any new factors that could be used to modify our peacetime formula for reserves?

Standards which were carefully compiled before the war have had to give way to substitutes. Will we go back to our old standards, or only part way? With construction bound to start up just as soon as the war is over, isn't it about time we were finding the answers?

A lot of old equipment was patched up and put in operation and it worked. Will it all be replaced, or only part? How does one decide?

Substitutes were made, such as wood for steel in certain structures. Is there any formula for evaluating these substitutes after the war?

Lighter construction was used, equipments were operated beyond what was formerly considered safe practice, and in many other ways old factors of safety were ignored. Did we go too far? Is some compromise going to be made between pre-war and emergency practices?

Some decisions, of course, will be predicated on later offerings of the manufacturers, but in general it should be possible to decide long before the war ends how much of the war emergency practices must be discarded and how much can be safely kept. Some practices are obviously temporary, but a great many cannot be judged so easily. Unless there is some systematic approach to the problem it is unlikely that the industry will receive full benefit of these war lessons.

Release of Materials for Civilian Use

ALMOST EVERY DAY brings a fresh batch of rumors of the impending release from restrictions of civilian goods using what for a long time have been critical materials. Each time these rumors are checked up with the proper officials of WPB and the answer is almost always the same.

It is true that the metals are in easier supply and it is quite probable that if the metal supply were the sole controlling factor a considerable amount, at least of some of the metals, could be released for non-military use. However, there is the manpower situation, which today is critical and therefore controlling. Even if the metals were in much larger supply it would not be possible to divert the large quantities of manpower that would be required for fabrication.

From time to time there undoubtedly will be, just as there has been in recent months, a special case made of material for certain civilian products. In each instance the material was made available because of some acute need or because of food. In the case of rural lines, for instance, more material was made available for conductors and equipment because food production could be increased.

Donald Nelson, WPB chairman, has said that he does not believe in the hair shirt philosophy, so it is reasonable to assume that WPB will not withhold anything from civilian use any longer than is necessary because of shortages of raw materials or labor or both.

The time will come, and soon we hope, when victory in at least one segment of the war will release labor and material for civilian products. When that time comes the early bird will be the one who catches the worm.

Some utilities have already reinstated canceled or deferred orders and others are getting ready to place orders. Those who wait until peace is declared to find out what they will need may find themselves on the end of a waiting line.

All for the Want of a Little Lamp

DINKY LITTLE LAMPS behind the red, white and green buttons on supervisory panels hardly seem critically important. Nevertheless when they are practically unobtainable, as now reported, they suddenly rise in significance. They can prove for some systems to be as indispensable as the horseshoe nail which lost the battle which cost Poor Richard's king his throne.

Philosophy varies from company to company as to the degree of automatic supervision provided for the control systems installed. Some are providing the telltale lights for only the more important circuits and equipments, others for practically everything but distribution feeders. Some even go so far as to supervise city networks so that every abnormality can be indicated at a central control point. Developments have been started for similar self-reporting equipment on the long rurals.

To whatever degree the reporting-back type of installation involves lights it is a definite factor in reliability of war-load, transportation and other services to know instantly whether things have functioned as they were intended. For those who do not have such extensive automatic facilities there is little opportunity to obtain them now. But for those who have them and rely on them it is disconcerting to find that such a simple thing as a peanut-sized lamp is obtainable only with difficulty. Lack of them throws burden on already burdened despatchers and their communication systems to make sure that lines are alive or dead as desired. It also has its bearing on safety for the line crews. Curtailment of catalogue varieties in lamp production should be corrected in so far as it ignored this requirement of power system operation and continuous supervision.

Washington Comment

R. N. LARKIN, Washington Correspondent

The Northwest Looks to Post-War Power

AN interesting question in the post-war electric power scene is the use to which the federally owned hydro capacity in the Northwest will be put when the war loads vanish. A concomitant angle is the rapidity with which proposed generating units at existing stations will be installed and with which new dams and generating stations will be authorized by a Congress which will have to consider tax reduction.

The White investigation (ELECTRICAL WORLD, October 23, 1943, page 3), conducted under a House resolution authorizing the irrigation and reclamation committee to study "plans for the development of the Columbia River Basin," has the ball. It disposed first of the politically touchy matter of whether the level of Flathead Lake was to be raised to provide additional upstream storage capacity for Bonneville and Grand Coulee power stations. Then it changed pace expertly and took up the matter of post-war uses for the available power in the Northwest.

Aluminum

Two leaders of the National Academy of Sciences testified last week as to possible methods of extracting alumina from clay. This is a topic close to the heart of any Northwestern Congressman, for the war has given the Northwest considerable aluminum reduction capacity, sizable aluminum fabrication capacity and a fervent desire to cling to an imposing place in the nation's post-war industrial scene. The power is there, and, claim the Northwestern Congressmen, so is a bountiful supply of clay from which alumina can be recovered to feed the aluminum plants, which can operate on the cheap energy generated by the mighty Columbia.

Move this aluminum and the Northwest's plentiful magnesium to the aircraft plants and the "other industries which are bound to spring up in a location which boasts thousands of skilled workers, the world's best climate and cheap ocean transport at its door," and you have, according to the Northwesterners, the makings of an industrial empire which will stand up to and compete with the traditional Boston-New York-Chicago triangle into which so much U. S. industry is concentrated. Though this sounds like the fond dream of a Board of Trade manager, it's the party line for the Northwestern Congressional delegation, and any challenge of it is countered with a blunt "Why not?"

Copper

Additional testimony came from engineers of the U. S. Bureau of Mines, who were quizzed on the possible uses of electricity in the mining of copper. From that point on, the exact program has not yet been made public, but Rep. Compton I. White, Idaho Democrat, who heads the committee, makes no secret of the fact that he will summon any one whom he thinks might furnish defensible data on the possibilities of steady consumption of sizable amounts of electric power in the Northwest after the war. White "expects" the study to continue for some time.

Nor is power the only consideration. Such other water uses as navigation and irrigation fit into the picture. Strong sentiment exists for rendering the Columbia River navigable to Lewiston, Idaho, for "the light metals capital of the world" could not compete so handily if it were served only by rail. And what sort of industrial empire would the Northwest be without a substantial agricultural industry? This last contingency, fortunately, is easily remediable by the opening up to agriculture of millions of acres which need only irrigation to make them bloom.

The whole thing may sound visionary, but the Northwesterners are in earnest. Consider the case of the three pilot plants for the development on a commercial scale of processes for extracting alumina from clays. These plants, one slated for South Carolina, one for Wyoming and another for the Northwest, kicked around WPB for months while bauxite was plentiful. With pig aluminum "running out of our ears," according to WPB Vice-Chairman Charles E. Wilson, the pilot plants were canceled some weeks ago because there is no need for additional aluminum and because manpower is so tight on the Pacific Coast. The ink was not dry on the cancellation before the Northwestern delegation was in full cry. A truculent letter sped from Interior Secretary Harold Ickes to Wilson pointing out that our domestic bauxite of a grade usable in existing plants would be exhausted in two years, and that without a proved process for extracting alumina from clay tremendous amounts of shipping and convoy craft would then be needed to bring bauxite in from South America.

Manpower

In about a week the cancellation was revoked and the program is now acceptable, depending on the availability of materials and manpower. Just to insure that it is not throttled on the basis of manpower, one Northwestern Congressman has compiled a list of 586 persons who will be available to construct and operate the proposed Northwestern plant, which will need 150 men to build and 300 to operate. The list has been certified as valid by the Regional Director of the War Manpower Commission, who pruned it down from almost 800 names.

The Northwesterners may not succeed, but it is obvious that they mean business. Their leaders represent both political parties. While all of them can accurately be termed "public ownership" men, by no means all of them are in complete sympathy with the more rabid public ownership expansionists who have held sway for the last decade. Each is convinced that he represents not just the wishes but the demands of the people back home.

NEWS OF THE WEEK

SFA Discards 60-Day Coal Operating Base

Strike affected production, but priorities order, somewhat revised, is expected soon on utility stocks — Ickes denounces Vawter of B.C.I. on "false representations" that coal supply is abundant

Although it was settled sooner than many had expected, last week's coal strike cost enough production to force the Solid Fuels Administration for War to discard plans for a 60-day operating base for coal-burning electric utilities.

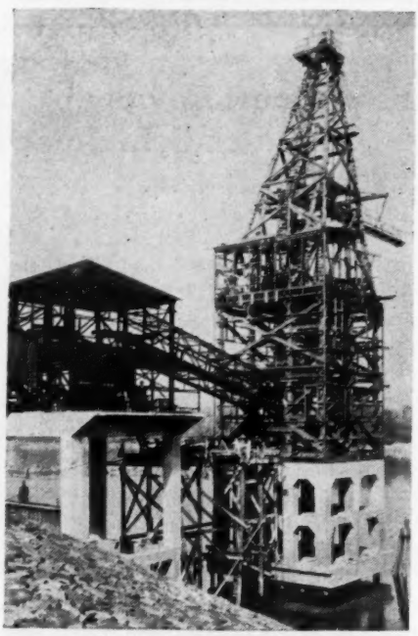
Priorities Order Revised

SFA was expected early this week to issue its priorities order (ELECTRICAL WORLD, October 30, 1943, page 61) before the week's end, to take effect immediately applying to orders for next month's coal deliveries. The priorities order has been revised somewhat from that described earlier in ELECTRICAL WORLD due to the impact of the coal strike, but the electric industry retains comparitively as good a position as it had under the earlier plan.

As explained to executives from the principal coal-burning areas at a meeting in Washington last Monday, the new program will operate as follows:

Metallurgical coal, including that for manufactured gas, will be allocated directly to users by SFA in amounts to keep the users operating at capacity and maintain adequate inventories. In so far as electric utilities require coal of this quality, and it is to a limited degree only, they will get their coal thus, except that if they have 30 days' or more supply of such special-purpose coals they may buy only 75 percent of their monthly burn during any month.

For all other grades of coal utilities with 45 days' supply or more will be allowed to buy only 75 percent of their monthly burn during the first month that the order is in effect. During the second and subsequent months that the program is in effect utilities possessing 60 days' supply or more will be allowed to buy only 75 percent of their monthly burn. At any time a utility's supply is below these two levels it will be allowed to purchase its full monthly burn plus enough extra coal to bring it up to the 45- or 60-day limits within two months. For instance, if during the second month the order is in effect a utility has only 50 days' supply it will be allowed to purchase its full burn for each of the two subsequent months plus an extra five days' supply each month to raise its stockpiles to 60 days' supply.



COAL TOWER—Construction was completed recently on this new coal unloading tower, built on the Connecticut River for the Hartford Electric Light Co. The timber portion of the tower was designed and built by the George P. Carver Engineering Co., Boston, and "Teco" timber connectors were employed

Industrial Users

During the life of the order all other industrial users will be allowed to buy their full monthly burn plus enough to bring them to 30 days in two months if they have less than 30 days' supply. If they have that much or more they will be allowed to buy only 75 percent of monthly requirements. No retail restrictions were imposed, but obviously no appreciable stockpiling will be allowed here.

It was the consensus of industry representatives at last Monday's meeting that, with continued help in the form of special directives where it is absolutely necessary, the industry can operate satisfactorily on the proposed plan. It was emphasized that SFA departed from its earlier proposal of a flat 60-day operating base for utilities only because of production losses of the latest strike, which cost an estimated 12,000,000 tons of bituminous coal.

Seriousness of the coal situation was further recognized at this week's meeting with the agreement that OWU's area power supply engineers will work out with their respective area operating committees plans which will consider not only area power supply and allocation but also the fuel situation. It will be the duty of these officials to insure that no area goes short of power because of maldistribution of the existing fuel supply. Such plans may include the shifting of area fuel stocks physically or in kilowatt-hours as may be deemed best.

Meantime, Solid Fuels Administrator Harold L. Ickes struck a blow for the over-all conservation campaign last week as he issued a scathing denunciation of General Manager Harry M. Vawter of the Bituminous Coal Institute, who has repeatedly proclaimed the coal industry's ability to produce to meet all needs.

"Your government at war needs the active co-operation of every coal consumer in the country to help balance the coal supply with our requirements through the practice of the utmost conservation in the use of fuel and through willingness to accept what coal may be available, whether it be of a quality and a kind to which they are accustomed," Ickes told Vawter in the most temperate paragraph of his lengthy letter. "You are not helping your country by falsely representing that the coal supply is abundant, thus creating the belief that no precautions are necessary by the consumer."

The statement was regarded as of highest significance by officials of the Office of War Utilities who are charged with the success of the voluntary electric conservation campaign. These officials pointed out that numerous electric utilities have reported that conflicting statements as to the existence or nonexistence of a coal shortage have introduced considerable difficulty into their prosecution of the electric campaign.

Ickes accused Vawter of "deliberate misrepresentation," of making a "special plea" for the bituminous coal industry, of "gravely injuring your fellow countrymen," of obstructionism and of false statements, adding: "I am certain that . . . a good many of the people in the United States will be able to see little difference between obstructing the vital wartime fuel program and actually giving aid and comfort to the enemy."

Denies Production Figures

The Solid Fuels Administrator denied categorically Vawter's assertion that the industry could produce 650,000,000 tons of coal next year if need be, and made out a convincing case in support of this denial. He added that SFA has thus far issued 3,000 special directives diverting coal to consumers who would have had nothing to burn otherwise. He ascribed Vawter's statements to the desire of "some in your industry . . . to wrest markets under cover of war from distressed competing fuels, and to place the blame for a coal shortage equally upon the miners and the government, . . ." adding:

"You would serve both your country and your industry better if you would join your business competitors, the Anthracite Industries, Inc., in helping advise consumers to take the steps necessary to carry on their coal-consuming activities as nearly normal as possible in a period of limited fuel supply. You might serve your industry and your country better if you would try to find a way to increase the manpower in the mines and improve the productivity of those who are in the mines.

"If you know of some supply of coal with which to fill the empty bins throughout the country, some supply which does not appear in our statistics, some supply which is unknown to officials of the Solid Fuels Administration, or if you know of some better way of distributing these supplies, it is your duty as a patriotic citizen to come to Washington and give us the benefit of your superior knowledge. If you know of no such supply, or of no better method of distribution, it is equally your duty as a patriotic citizen to hold your peace."

Unfreeze Coal in Transit

Two million tons of bituminous coal which was frozen in transit last week by Solid Fuels Administrator Ickes when all coal mining operations ceased has been released and is being allocated to points of greatest need under specific SFA orders. Ickes said the release was ordered to expedite the return of coal distribution to its normal pattern in view of the increased production expected with the settlement of the strike.

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High Court Review On Rates Scheduled

A final decision on whether the government's economic stabilization machinery takes precedence over state and other local regulatory bodies in the adjudication of wartime rate increases was assured this week when the United States Supreme Court granted an appeal for review of an adverse decision brought by the Office of Price Administration and Economic Stabilizer Fred M. Vinson.

The case is that of OPA and the government against the District of Columbia Public Utilities Commission, which a year ago granted the Washington Gas Light Co. an annual rate increase of approximately $200,000 on the basis of the sliding scale agreement which has governed District utilities for nearly two decades.

OPA appealed the order and the District Court ruled against the increase, but the District Court of Appeals reversed the lower court on appeal by the commission. OPA and Vinson thereupon appealed for a writ of certiorari, asking high court review which has been granted.

Plaintiff's request for the review held the case "of grave importance to the national stabilization program," which it said, must deny rate increases whether merited or not under peace-time criteria, which are not absolutely necessary to protect a utility's financial position.

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Public Service of N. J. Cited in FPC Order

$68,000,000 involved in 30-day "show cause" on excess cost

The Federal Power Commission has directed the Public Service Electric & Gas Co., Newark, N. J., to show cause within 30 days why it should not be ordered to (1) eliminate $9,479,956.02 out of a total of $38,565,513.13 in write-ups and other inflationary items in its plant accounts, principally through charges to earned surplus, (2) submit plans as to the specific accounts through which there shall be written off the $29,085,557.11 balance of write-ups and inflationary items, and (3) submit plans for the disposition of an additional $2[illegible] 328,210.96 representing excess of purchase cost over original cost of plant acquired as operating units or systems.

In the past the commission has required the immediate elimination chiefly through earned or capital surplus, of inflationary items covered by (1) and (2) above. In many cases the Commission has authorized amounts similar in character to (3) above to be eliminated gradually through amortization over a period in the future rather than through immediate charges to earned surplus or other accounts. However, of the $29,328,210.96 in (3) above the commission's staff has recommended, due to the circumstances surrounding the acquisition of one property, that $14,538,896.96 be written off at once.

In substance, therefore, the company has been ordered to show cause why it should not immediately eliminate $5[illegible] 104,410.09 in write-ups and inflation from its plant accounts and submit plans for the gradual elimination of $14,789,314.00 representing the difference between purchase cost and original cost of acquired properties.

The total of the foregoing amounts is $67,893,724.09, which represents about 27 percent excess over the $257,78[illegible] 941.20 found by the commission's staff to be the original cost of the electric and common utility properties of the company as of January 1, 1938.

System Operators Analyze Northeastern Problems

Pennsylvania Electric Association committee discusses load estimates and probable outlook in view of dubious coal situation, low water areas and delays in completing new units

In general loads in the northeastern quarter of the country are already above or close to the estimated fall peaks and reserves in some places are so slim as to be expressed in terms of moisture and ash content of the dubious coal. Certain utilities whose estimates proved low feel they are "skating on thin ice" and just gambling on better hydro in 1944. Coal stocks are reported in spots as low as one week's supply. Delays in completion of units and the increasing proportion of emergency to total outages of generating station facilities were further items of report at a meeting of the Pennsylvania Electric Association's systems operation committee in Pittsburgh, November 4 and 5, 1943. System operators from Illinois, Indiana, Ohio, Virginia, Maryland, New Jersey, New York and New England participated with those of the Pennsylvania area.

Dimout Relaxation

Effect of the relaxation of the dimout in the eastern area has apparently not been much increase, but it may be enough to shift peaks back to evenings. Maintenance is lagging behind schedule because of manpower. Concomitances of unfavorable circumstances have been accentuated by low water in some areas; crowding of small semi-obsolete stations on the lesser participating systems plus the outages of large, high-pressure equipments on big systems keep the operators juggling capacities and loads as never before. Maneuvering is tight, but they report they have managed to get by. The human element is equally precarious because of the strains.

Emergency conditions can, however, apparently be met because various new measures have been subjected to tryout. One company has completely equipped emergency dispatching centers. C. P. Corey of New England Power reported on an "NC" (no communications) program for 48-hour operation with areas and facilities devastated by storm or bombing. A recent daytime test for ten hours put all operators in 29 plants "on their own" in accordance with previous blanket instructions and long-standing principles of decentralized functioning. Economy was sacrificed for the period. No warning was given, but everything behaved without untoward results.

Interconnection Load

Subsequent discussions of interconnection load and frequency control brought out the possibility of relieving load by reduction in voltage but not in frequency. Up to 10 percent could be hazarded this way in extreme emergency, according to J. E. McCormack (New York), where there is little load on regulators. Another area lowered loading about 2½ percent by a 2½ percent voltage reduction in several stringencies. Complaints were negligible.

It was evident from the discussion that the holding of clock-time is beyond wartime possibility. McCormack called frequency adjustment the finest of tools for control of line loading and spoke highly of bias control in cutting momentary swings. Earle Wild, area representative of OWU, said that base stations would have little difficulty in holding frequency if system members would hold tie-line loadings; small, uneconomical stations need accurate frequency meters in order to collaborate. Comment was made on the lesser difficulty of controlling low-pressure units. One system reports adding governor refinements to deal with large industrial swings.

W. P. Wilder of Niagara-Hudson passed around copies of a multi-scale paper slide-rule to determine the propriety of economy transfers as affected by line loss on a multi-link system.

Fixed Rate Business

At a luncheon meeting E. C. Stone, vice-president of Duquesne Light, warned of the competitive position of a fixed-rate business in an era of post-war inflation and said the happy discovery of unrealized capacity in interconnected systems was something that the future might dictate would have to be duplicated or surpassed.

Discussion by W. R. Hamilton (West Penn) of 320 experimental qualification tests voluntarily taken by 112 operators brought out that the typical operator is non-neurotic, self-sufficient, wholesomely self-confident, and not inclined toward dominance or extroversion. The process of selecting and advancing operators in manning the 176 positions at 26 stations on Duquesne Light was detailed by K. W. Kaylor, superintendent of operations.

Fifty attended the four sessions.

WITHOUT FANFARE—Boston Edison's new Everett steam plant went on the line November 1, adding a 50,000-kw. initial turbine unit, steam generating and auxiliary equipment to the company's productive facilities. Original plans in 1940 called for two units aggregating 100,000 kw., but last year priorities on the second unit were revoked. Jackson & Moreland, Boston, were the supervising engineers and Thomas O'Connor & Co., Inc., were the general contractors for the new station. L. to r., Robert E. Dillon, vice-president Boston Edison; President James V. Toner, closing switch which energized the new plant; Ralph D. Booth of Jackson & Moreland; Austin O'Connor of Thomas O'Connor & Co., Inc.

New Bill Would Remove REA Loan Restrictions

Measure introduced by Rep. Fulmer authorizes RFC chairman to lend sums appropriated by Congress to Secretary of Agriculture to void present "ceiling" on REA funds out on loan at one time

A bill removing the rigid restrictions of the Rural Electrification Act on the amount of money which may be on loan by the Rural Electrification Administration at one time and authorizing the chairman of the Reconstruction Finance Corporation to lend sums appropriated by Congress to the Secretary of Agriculture has been introduced by Rep. Hampton P. Fulmer, South Carolina Democrat.

In some quarters the bill was interpreted as the Administration's answer to the pending investigation of REA. These observers pointed out that under the provisions of the Fulmer bill, RFC would maintain credit for REA in the amount approved by Congress. Co-ops would have their loans approved by the Secretary of Agriculture, not REA Administrator Harry Slattery, as heretofore, and would then present their claims directly to REA. This move, it was pointed out, would further reduce him to the status of a mere administrator. Fulmer, chairman of the House committee on agriculture, is regarded as an Administration stalwart.

Limits Interest Rate

The bill, which is largely technical, carries clauses limiting the interest which co-ops may be charged to 3 percent. This figure is about the ceiling on existing REA loans, many of which are at lower rates.

If written into law, the bill would eliminate such parliamentary tangles as delayed the vote upon REA's appropriation last spring when the Agriculture Department appropriation bill was before Congress. The provision allowing RFC to advance the money was termed legislation in an appropriation bill and stricken on a point of order, with considerable resulting confusion among members as to just what they were voting for.

The bill would also substitute for the existing ceilings on REA obligations which may be outstanding at any one time a provision authorizing REA to have outstanding as much in obligations as is necessary to cover provisions of the law. This becomes an elastic ceiling under the earlier provision which allows RFC to loan as much money as Congress may appropriate.

The National Rural Electric Co-operative Administration, meanwhile, attempted to obtain action on the Rankin-Russell bill (ELECTRICAL WORLD, January 23, 1943, page 132) which authorizes appropriations to REA of $100,000,000 yearly, which positively allows acquisition of going systems, which provides for 50-year loan amortization, which lowers the loan interest rate on REA loans and which increases the statutory size of a rural area to include towns of 10,000 population. NRECA's national board approved a resolution asking immediate passage of the bill, which has lain dormant since its introduction early this year.

Flathead Dam Bill

Elsewhere on the legislative front identical bills providing for the immediate construction of a storage dam and power plant at the Hungry Horse site on the South Fork of the Flathead River, in Montana, were introduced by Rep. Mike Mansfield and Sen. Burton K. Wheeler, Montana Democrats.

The move followed the abandonment of a proposal to raise the levels of Flathead Lake in Montana and Lake Pend Oreille, in Idaho, to provide upstream storage for Grand Coulee and Bonneville power stations. Recent conferences between officials of the Office of War Utilities and Bonneville Power Administrator Paul Raver saw Raver emphasize the necessity for immediate construction of some upstream storage facilities. When WPB officials remained cool to Raver's demands for immediate action, it is apparent, Raver took his case to the Montana Congressmen.

Under the proposed bills Interior Secretary Harold L. Ickes would be empowered to start immediate construction of enough of the proposed dam to impound 1,000,000-acre-feet of water and accompanying power facilities. Later (after the war) he would be authorized to complete the dam to a storage capacity of 1,500,000-acre-feet.

In line with testimony offered at Kalispell, Mont., this summer before the White committee (ELECTRICAL WORLD, October 23, 1943, page 3) the bills provide that benefits of the dam shall be "primarily (for use) in the state of Montana but also downstream . . ."

Considerable question exists as to whether WPB, having control over materials and projects, would be required to grant priorities for the dam even though Congress voted its immediate construction. It is believed that while WPB might find the materials for the dam, it would balk at authorizing the extra generating capacity.

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Consumer Goods Survey Under Way

Census Bureau employees began a nationwide consumer survey this week by which the Office of Civilian Requirements hopes to ascertain accurately the availability and the efficiency of 115 types of domestic goods and services, including numerous electrical appliances.

The survey, which will cover 7,000 households selected to furnish a cross-section of the entire nation, was drawn up in consultation with directors of the outstanding agencies in the public opinion field. Its results will be added to those already obtained by OCR in its own spot checks. Answers to these questions are being sought: (1) to what extent are shortages causing hardship? (2) What scarce or unavailable items are most needed? Is their absence interfering with productive efficiency? (3) Are available consumer goods being distributed fairly? (4) What is the quantity and operating condition of such durable goods as electric irons and washers now in the hands of consumers?

Electric appliances on which data will be sought include radios, irons, washing machines, cooking stoves, mechanical refrigerators, sewing machines and vacuum cleaners. Availability of repair services for these appliances also will be checked.

The survey also will cover domestic utensils, women's and men's clothing, farm equipment, small metal sundries and such domestic services as laundry, dry cleaning and shoe repair.

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TVA Units Scheduled

Two more individual projects of the 1945 power program have been granted AA-3 priorities and will be scheduled for completion as soon as possible, OWU officials announced this week.

New projects are a 32,000-kw. hydro unit for TVA's Kentucky Dam, the fourth such generator at that dam, and a 60,000-kw. steam unit at Watts Bar steam plant of the TVA system, the fourth generator at that plant.

P.C.E.A. PANEL DISCUSSION GROUP—George C. Tenney (center) editor of *Electrical West*, acted as moderator at the P.C.E.A. panel discussion on operating economics. In the left group in the usual order: J. P. Jollyman, Pacific Gas & Electric; C. E. Grunsky, Coast Counties Gas & Electric; W. L'Hommedieu, Westinghouse; I. W. Borda, Okonite. In the right group: George E. Kimball, Industrial Accident Commission; W. C. Smith, General Electric; S. J. Lisberger, Pacific Gas & Electric; R. A. Wehe, California Railroad Commission

Operating, New-Business Problems Occupy P.C.E.A.

Panel discussion of operating economics section, conducted by eight representative industry men, proves highlight of two conferences, held in Los Angeles Oct. 27 and San Francisco Nov. 4

"Strong industry as well as strong individuals seek opportunity, not security alone. The electrical industry has been strong, let's keep it that way. The things we have done won't destroy us, but the things not done might." In these words President Frank C. Angle, Pacific district manager, Allis-Chalmers, expressed the theme of two wartime conferences of the Pacific Coast Electrical Association held in Los Angeles, October 27 and in San Francisco November 4.

Panel Discussion Feature

Highlighting both meetings was a panel discussion of the operating economics section with George C. Tenney, editor *Electrical West*, as moderator. This was an entirely new feature of P.C.E.A. conferences and proved an outstanding success. It was handled much as several current national radio programs are conducted and produced carefully studied answers and conclusions as contrasted with spur of the moment comment of the ordinary type of meeting.

The panel consisted of eight representative industry men at both meetings, who gave their views on such subjects as retention of forced-draft cooling of large transformers, replacement of iron wire after the war, synthetic insulations, wartime dispensation of codes and ordinances, women in the operating and construction departments of utilities, the practice of up-rating equipment, bi-monthly billing and several others.

The consensus was that more experience is needed with forced cooling, but that the operation has proved successful and will continue; in general, iron wire will be replaced; synthetic insulations have proved entirely successful in the 600-volt class, but not entirely in the 2,300-5,000-volt range; however problems are rapidly being solved; some code deviations are sound and will be retained; the problem of women in industry will largely take care of itself; up-rating of equipment has always been practiced to some extent and is purely a matter of good judgment and economics; bi-monthly billing will gradually pass out after the war, as it did after World War I.

Three excellent papers dealt with prime mover governing, telemetering and tie line control as applied to power pools. N. B. Hinson, Southern California Edison Co., Ltd., gave some high spots of the Pacific Southwest power interchange. Intergrated operation of nine systems with total capacity at the end of 1943 of 4,145,000 kw. and generating an estimated 19,000,000,000 kw-hr. are operating so successfully that interchange will undoubtedly continue after the war. Plans for several additions to generating capacity were canceled as a result of the pool with much critical material and war production capacity released as a result.

In the business development section, J. A. Hill, chairman residential wiring committee, said that the time will be

P.C.E.A. CONFEREES—Left, Fred Garrison, General Electric, and W. H. Talbot, San Diego Gas & Electric. Center, W. E. Row, Southern California Edison; Ralph Hopkins, Westinghouse; A. A. Kroneberg, Southern California Edison. Right, Ralph Walbridge, general commercial manager, and C. E. Houston, vice-president and general manager of Southern California Edison Co.

propitious immediately after the war for the elimination of No. 14 wire altogether and made a plea for concerted industry action at this time to bring this about. No. 14 has proved inadequate for all lighting and appliance circuits; it is universally overfused; inspectors will withdraw limitation of the number of outlets on circuits with type S fuses or breakers, making No. 14 further inadequate; jobbers must carry heavy stocks in a number of different insulations and colors; it actually costs wire manufacturers more to produce than No. 12 on account of an extra draw to make No. 14; most of a utility's service calls are occasioned by trouble on No. 14 circuits and in every respect No. 14 wire has become obsolete and the dies should be scrapped after the war.

Standardization of sizes and types of water heaters is highly desirable, said B. W. Reynolds, P.G. & E., but we cannot agree with N.E.M.A. and others working on this problem on the ratios of heater capacity to tank sizes they propose, which leaves the problem far from solution. H. Garfinkel, G. E. Acceptance Corp., stated that time payments on appliances is going to be a very important factor after the war, despite accumulation of war bonds in the hands of the public. Forrest Naylor, P.G. & E., was emphatic on the matter of guarantees on appliances and advocated the automotive industry's policy of building a good product and letting it stand on its own feet.

Post-War Lighting

A comprehensive review of post-war lighting markets and types of light sources was presented by S. H. Hazelton, G. E. lamp division. Cold cathode will come prominently into the fluorescent field after the war and he predicted that 30 percent of new commercial and industrial lighting following the war will be of that type.

Both Los Angeles and San Francisco meetings found more than 300 industry men at each keenly alive to problems of wartime and the peacetime to follow and demonstrated that they will be fully abreast of the problems that arise.

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Labor Shortage Areas

Seven new areas have been classified as acute labor shortage areas by the War Manpower Commission, raising the nationwide total from 70 to 77. New Group I areas (acute labor shortage) are: DeKalb, Ill.; Newton, Iowa; Orlando, Fla.; Texarkana, Tex.; Burlington, Iowa; New Bern, N. C., and Tooele, Utah.

Six-Month Report on "Death in the Dimout"

A graphic picture of the effects of dimouts on traffic accidents is contained in a recent report issued by the Traffic Safety and Research Section of Connecticut's Department of Motor Vehicles, which summarizes six months traffic accident experience both before and after the dimouts. The report was compiled by Richard E. Simpson, illuminating engineering consultant of the Connecticut War Council's protective division.

The report emphasizes an increase of 46.7 percent in the night rural incidence accident rate, a 53.1 percent jump in the night urban incidence rate, and a net increase in the night incidence rate of 52 percent. The pedestrian night incidence rate, during the same six-month period, increased 102.5 percent.

The comparison was made from the period January 1, 1942, to July 1, 1942, and January 1, 1942, to July 1, 1943, and the results of the researches are summarized in a series of tables which accompanies the report which is entitled "Postscript to 'Danger in the Dimout.'"

Accidents per million vehicle miles, the report shows, showed a decrease of 8.9 percent for rural sections in daylight, but an increase of 46.7 percent for night. In urban areas there was a decrease of 1.6 percent in day accidents and an increase of 53.1 percent in night accidents. For both areas the total showed that while accidents during the period were down 3.5 percent in daytime (less cars on the road, slower driving, etc.), night accidents were up 52 percent.

Combined rural and urban areas showed the following breakdowns for the period:

A decrease of 2.3 percent in property damage, 5.1 percent in injuries, 16.6 percent in fatalities and 4 percent for pedestrians during the daylight hours. At nighttime, on the other hand, with dimouts in effect, the score showed a 44 percent increase in property damage, a 41.9 percent increase in injuries, a 43.1 percent increase in fatalities and a 102 percent increase in accidents to pedestrians.

The cost of accidents per million vehicle-miles shows a decrease of 3.9 percent during the daylight hours and an increase of 43 percent for the night period.

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Bellows Falls Hydro License Authorized

The Federal Power Commission last week authorized the issuance of a federal license, for a period terminating in 1970, to the Bellows Falls Hydro-Electric Corp. for the 5,220-kw. Wilder hydro-electric project on the Connecticut River. Application for the license was filed August 26, 1942, by Bellows Falls and the Olcott Falls Co., and all the facilities involved were subsequently sold to the Bellows Falls corporation by Olcott Falls.

The Wilder transmission facilities are directly connected with facilities of the Granite State Electric Co., Central Vermont Public Service Corp. and indirectly with the New England Power system.

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PUD Starts Suit

Public Utility Districts No. 1 of Douglas and Clallam counties, in the state of Washington, have brought suit in the Superior Court at Olympia to compel the Washington Water Power Co. and the Puget Sound Power & Light Co., respectively, to furnish them with schedules of wholesale rates at which they would provide the districts with electrical energy.

MEETINGS

Pennsylvania Electric Association—Meter Committee, Benjamin Franklin Hotel, Philadelphia, Pa., December 10. Bradley M. Smith, chairman, P. O. Box 860, Erie, Pa.

Previously Listed

American Society of Mechanical Engineers—Annual meeting, Pennsylvania Hotel, New York, N. Y., November 29-December 3. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

American Society of Agricultural Engineers—Fall meeting, LaSalle Hotel, Chicago, Ill., December 6-8. Raymond Olney, secretary, St. Joseph, Mich.

19th Exposition of Chemical Industries—Madison Square Garden, New York, N. Y., December 6-11. C. F. Roth, manager, Exposition of Chemical Industries, Grand Central Palace, New York, N. Y.

National Association of Manufacturers—2nd War Congress of American Industry, Waldorf Astoria Hotel, New York, N. Y., December 8-10. J. M. Boyd, secretary, 14 W. 49th Street, New York, N. Y.

American Standards Association—Annual meeting, New York, N. Y., December 10. P. G. Agnew, secretary, 29 West 39th Street, New York, N. Y.

Technical Valuation Society—Annual forum and business meeting, Building Trades Club, 2 Park Ave., New York, N. Y., December 11. W. C. Fisher, chairman, Room 516, 4 Irving Place, New York, N. Y.

American Society of Civil Engineers—Annual meeting, Engineering Societies Building, New York, N. Y., January 19-21. George T. Seabury, secretary, 33 West 39th St., New York, N. Y.

American Institute of Electrical Engineers—National technical meeting, Engineering Societies Building, New York, N. Y., January 24-28. H. H. Henline, secretary, 33 West 39th Street, New York, N. Y.

Sales Executives' Conference—Netherland Plaza Hotel, Cincinnati, Ohio, February 3-4. H. E. Dexter, secretary-treasurer, 50 Market Street, Poughkeepsie, N. Y.

Output Off in Election Week

The output curve dropped slightly during the Election Day week ended November 6. The amount of electrical energy distributed by the electric light and power industry totaled 4,413,863,000 kw.-hr., compared to 4,452,592,000 kw.-hr. the week previous, according to the Edison Electric Institute, source of the figures. The total for the latest week compares with the 3,761,961,000 kw.-hr. distributed during the corresponding week in 1942—an increase of 17.3 percent.

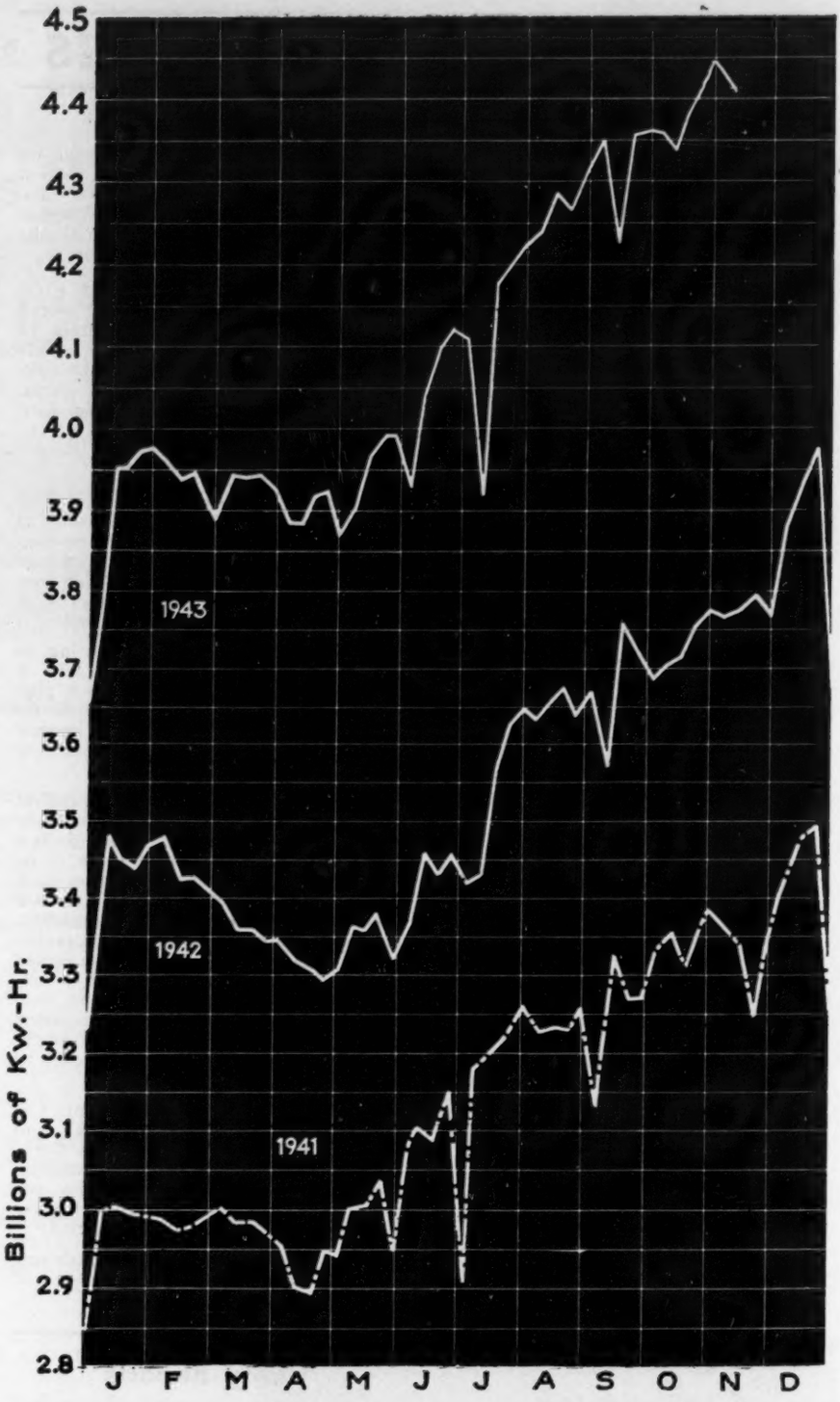
Only three of the seven major geographic areas of the country contributed to the slight falling off—the New England, the Mid-Atlantic and the Central Industrial regions. The Pacific Coast area continued to lead the country in gains for the latest week over the 1942 week with a 29.7 percent gain for the week ended November 6, as compared to a 26.1 percent gain registered the week previous. The Southern states were back in second place with a 20.4 percent increase over the '42 week, and the Mid-Atlantic section, with an 18.1 percent increase, was in third place. Lowest divisions, from the standpoint of increases over 1942, were the New England, with an 8.2 percent gain, and the West Central, with an 8.7 percent gain.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Nov. 6	4,414	Nov. 7	3,762	Nov. 8	3,368
Oct. 30	4,452	Oct. 31	3,775	Nov. 1	3,380
Oct. 23	4,415	Oct. 24	3,752	Oct. 25	3,341
Oct. 16	4,382	Oct. 17	3,717	Oct. 18	3,313
Oct. 9	4,342	Oct. 10	3,702	Oct. 11	3,355
Oct. 2	4,359	Oct. 3	3,683	Oct. 4	3,330
Sept. 25	4,360	Sept. 26	3,720	Sept. 27	3,273
Sept. 18	4,358	Sept. 19	3,757	Sept. 20	3,273
Sept. 11	4,229	Sept. 12	3,583	Sept. 13	3,322
Sept. 4	4,351	Sept. 5	3,673	Sept. 6	3,133

Percent Change from Previous Year

	Week Ending		
	Nov. 6	Oct. 30	Oct. 23
New England	+ 8.2	+ 9.4	+ 7.0
Mid-Atlantic	+18.1	+21.4	+19.7
Central Industrial	+12.7	+14.9	+15.2
West Central	+ 8.7	+ 8.5	+ 9.2
Southern States	+20.4	+19.6	+19.7
Rocky Mountain	+15.5	+13.8	+14.7
Pacific Coast	+29.7	+26.1	+25.3
Total United States	+17.3	+18.0	+17.7



Consumers District Buys Nebraska Hydro

The Consumers Public Power District of Columbus, Neb., recently completed purchase of the outstanding stock of the Nebraska Hydro-Electric Power Co., including the hydro plant on the Niobrara River, southeast of Spencer, Neb., according to a recent announcement by E. A. Wisco, vice-president and general manager of Nebraska Hydro-Electric. The purchase price was $455,000, plus prepaid insurance and unbilled revenues aggregating approximately $465,000.

The Spencer power house was started in 1925 and the first unit was placed in operation in 1927. Output was sold at wholesale to the Interstate Power Co., which was purchased by the Consumers Public Power District at the close of 1940. Consumers has also been buying the entire output of the Spencer plant.

Utility Coal Consumption

Electric utility power plants consumed 7,280,275 tons of coal in September, the Federal Power Commission reports. Of the total consumed 6,970,481 tons were bituminous coal, an increase of 0.7 percent over August, 1943, consumption, and 309,794 tons were anthracite, which was a decrease of 3.0 percent when compared with August, the report indicates.

SEC DECISIONS-HEARINGS

The Securities and Exchange Commission, last week, in a series of orders and opinions affecting electric utilities companies:

APPROVED A PROPOSAL by Cities Service Power & Light Co. to donate to Ohio Public Service Co., a subsidiary, all the outstanding capital stock of Alliance Public Service Co., another subsidiary. Ohio Public Service will record the donation by crediting $460,144 to capital surplus, the sum comprising the net book worth of Alliance as of June 30, 1943. Alliance will be liquidated as of June 30.

APPROVED AN AMENDED PLAN of recapitalization for the Virginia Public Service Co., subsidiary of General Gas & Electric Corp., designed to distribute its voting power "fairly and equitably" among securities holders. The plan was designed to conform to the commission's order of October 15. The plan provides for the return to Virginia of $1,165,166 held in escrow under commission order; extinguishment of all Virginia's existing preferred stock, together with unpaid dividends on such stock, and issuance by Virginia in lieu thereof of 1,079,649 shares of new common stock.

GRANTED A SIX-MONTH EXTENSION of the time within which the Washington Railway & Electric Co. and the Washington & Rockville Railway Co., both Maryland subsidiaries of North American Co., must dispose of their interests in certain companies in accordance with an SEC order dated April 14, 1942.

APPROVED THE PROPOSAL of Southern Colorado Power Co., a subsidiary of Standard Gas & Electric Co., to refund and redeem its outstanding bonds as a prelude to the consummation of its proposed recapitalization plan. The company plans to sell at competitive bidding $5,500,000 face amount of first mortgage bonds, due 1968, and $1,200,000 face amount of serial notes, to institutional investors. Proceeds of the sale, together with treasury funds, will be applied to the refunding of presently outstanding mortgage gold bonds, series A, 6 percent, due 1947, in the face amount of $6,763,400, at the redemption price of 102.

GRANTED CRESCENT PUBLIC SERVICE CO. and its subsidiary, Oklahoma Utilities Co., an extension of time to January 31, 1944, within which to comply with a commission order of October 7 regarding the sale of certain utility properties and the redemption of certain securities.

Applications Filed

REQUEST OF THE NORTH AMERICAN CO. for authority to pay a dividend on the outstanding shares of its common stock in shares of Pacific Gas & Electric Co. common stock, par value $25, on January 3, 1944. Proposed dividend will be at the rate of one share of Pacific G. & E. common for each 100 shares of North American common.

PROPOSAL OF MIDDLE WEST CORP., as a step in its integration plan, to sell its entire interest in the Missouri Gas & Electric Service Co. to Ralph J. Green of Warrensburg, Mo., for $352,400 in cash. Proceeds of the sale would be distributed to Middle West stockholders within two years after receiving them. Mr. Green is president and holder of approximately 24.8 percent of the outstanding common stock of Missouri Public Service Corp., whose properties are adjacent to those of the Middle West property in western Missouri.

PROPOSAL OF OKLAHOMA GAS & ELECTRIC CO., subsidiary of Standard Power & Light Corp., to solicit proxies from its common and preferred stockholders to vote on certain matters in regard to the company's plan of recapitalization at a special meeting to be held in Oklahoma City, December 7.

Hearings Scheduled

NOVEMBER 12: Hearing on proposal of Pennsylvania Electric Co. to refinance its cumulative preferred stock, 5.10 percent, series A, by making an offer of exchange to the present holders whereby they can exchange each share held for one share of 4.40 percent preferred, plus $1 in cash.

NOVEMBER 17: Consolidated hearing on amendments filed by Peoples Light & Power Co. and its subsidiaries to a plan originally filed with the commission for compliance with the geographic integration provisions of the Holding Company Act.

NOVEMBER 18: Hearing on proposal of Public Service Electric & Gas Co., subsidiary of Public Service Corp. of New Jersey, to reduce the stated value of its 17,885,290 shares of non-par common stock from $196,205,800 to $170,000,000, without reducing the number of shares outstanding. The difference would be set up as a capital surplus account which, together with earned surplus and company reserves, will be sufficient to cover adjustments on the company's books which may result from orders by the Federal Power Commission or the Board of Public Utility Commissioners of New Jersey.

NOVEMBER 22: Proposal of Standard Gas & Electric Co. to sell A. C. Allyn & Co. of Chicago, and Equitable Securities Corp., of Nashville, Tenn., for a total consideration of $800,000, certain securities and claims against its subsidiary, Market Street Railway Co., a California corporation.

NOVEMBER 29: Hearing on amendments filed by Community Gas & Power Co. and its subsidiary American Gas & Power Co. to a previously amended plan filed under Section 11 (e) of the Holding Company Act for compliance with Section 11 (b) of the Act.

NOVEMBER 29: Continuation of a hearing, scheduled for November 22, on consolidated matters affecting the New England Gas & Electric Association and trustees of the Associated Gas & Electric system.

DECEMBER 7: Postponement of a hearing, originally scheduled for November 9, on a plan of reorganization of the Niagara Hudson system under the Holding Company Act. Postponement was required because hearings by the New York Public Service Commission on the plan reconvened November 8 and are still in progress.

Utility Reports

	Net Income 1943	1942
*Alabama Power	$5,139,851	$3,206,987
*Cleveland Elec. Illum.	6,255,059	6,439,757
*Commonwealth Edison and subs	21,972,364	23,943,452
*Cons. Gas Elec. Lt. & Pwr. (Balto.) and sub.	6,063,377	6,288,171
*Florida Power & Light	2,424,601	1,472,381
*Georgia Power	6,394,067	5,443,802
*Indianapolis Pwr. & Lt.	2,125,404	2,199,735
*Iowa Public Service	759,414	715,213
*Kansas Gas & Electric	1,682,791	1,173,373
*Nebraska Power	1,847,412	1,195,442
*Northwestern Electric	717,817	588,489
*Pacific Ltg. and subs	6,043,088	6,839,799
*Philadelphia Elec. and subs	15,797,323	17,118,057
*Sioux City Gas & Elec.	734,972	458,841

* Twelve months ended September 30.

FPC Cities Louisiana P. & L. on "Write-Ups"

The Federal Power Commission announced last week its order directing the Louisiana Power & Light Co. to make adjustments in its plant accounts totaling $11,687,357.26, of which $7,637,202.98 in write-ups and other inflationary items is ordered to be eliminated immediately through charges to reserve for depreciation, capital surplus, earned surplus and other accounts, and $3,854,375.17, representing the difference between purchase cost and original cost of acquired properties, is to be eliminated through amortization over a 15-year period ending December 31, 1957, through charges to miscellaneous amortization (Account 537). Disposition of $195,779.11, representing profit on fees paid an affiliated construction company, Phoenix Utility Co., has been deferred by the commission on the company's request, pending a decision by the United States Circuit Court of Appeals for the Third Circuit in *Pennsylvania Power & Light Company v. Federal Power Commission.*

The company's revised original cost studies showed the original cost of the Louisiana Power & Light's electric plant as of January 1, 1937 to be $18,644,518.31; thus the adjustments of $11,687,357.26 constitute an excess over original cost of approximately 63 percent.

Discussing the larger write-ups in the company's plant accounts, the order points out that the plant account of Louisiana was written up by a net amount of $6,227,353.76 through issuance of securities, at the time of the Louisiana company's formation in 1927 by Electric Power & Light Corp. (an Electric Bond & Share subsidiary), that subsequent write-ups amounted to $299,441.14, and that excessive interest and other improper charges amounted to $42,502.48.

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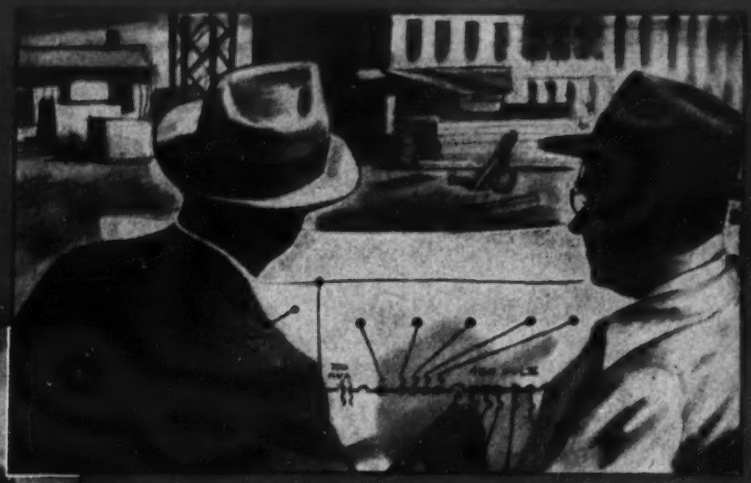
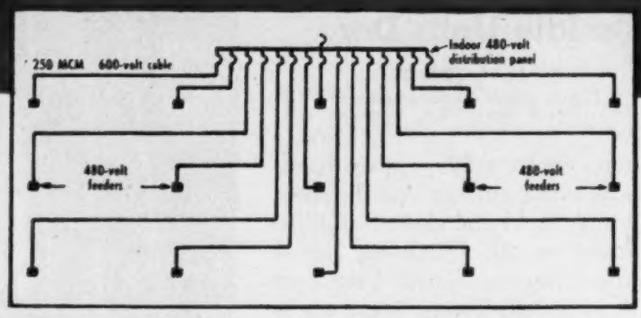
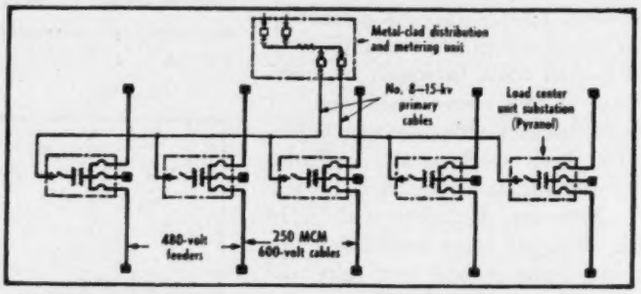




OLD-STYLE SYSTEM. Critical materials—95,000 pounds. Note the long, heavy, secondary-cable runs to feed the fifteen load centers. And the capacity of this system can not be increased easily.


Metal-clad distribution and metering unit
No. 8—15-kv primary cables
Load center unit substation (Pyranol)
480-volt feeders
250 MCM 600-volt cables

LOAD-CENTER SYSTEM. Critical materials—74,500 pounds. This system requires 10 tons less critical materials than the one above, and saves more than 20 per cent of the cost. Capacity can be increased easily to handle new loads, or to meet shifting load conditions.

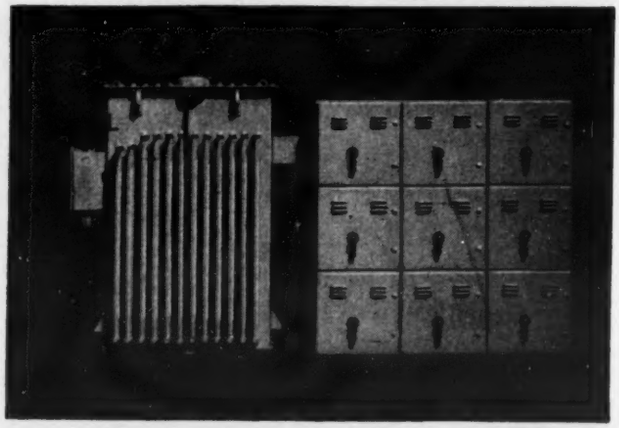
oad-center distribution makes that ving possible

ing load-center unit substations, you can install a com-te, co-ordinated power system that requires far less per and other vital material than you'd need for an -style system with "piecemeal" substations.

e recent installation saved 39,500 pounds of copper—ough to make 1,500,000 small shell casings. (At the right diagrams of typical medium-size systems to show how is possible.) On large installations, many times this ount can be saved.

tory-built, safety-enclosed unit substations, which make d-center distribution possible, are designed for serving ds of 600 volts and below from incoming lines up to 13.2 They are delivered ready to install right in the same m with the machinery to be supplied with power. You add substation capacity *where* you need it, *when* you nt it, largely eliminating the high cost of long, heavy, -voltage circuits from a distant substation.

E unit substations, installed on the load-center plan, minate troublesome voltage drop, and improve the per-mance of your electric equipment. Load-center distribu-n is economical, both in its use of critical materials and ts over-all cost. It is the most reliable, flexible, and time-ing method yet devised for industrial power distribution. re information in our bulletin, No. GEA-3592. *General ctric Company, Schenectady, N. Y.*



Load-center unit substations can be installed on overhead platforms, over washrooms, or between column centers, etc. to save space. Their infrequent need for inspection and maintenance saves you many valuable hours of maintenance time.

NIT SUBSTATIONS

BUY WAR BONDS

GENERAL ELECTRIC

302-19-5900

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

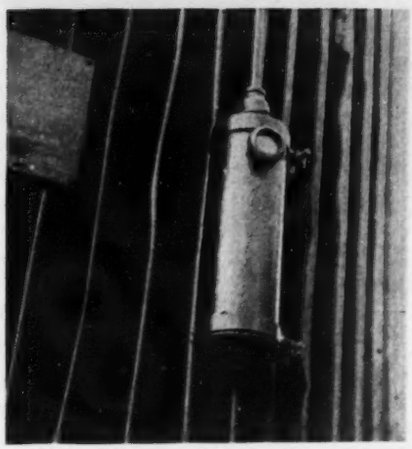
Silica-Gel Breathers Keep Idle Units Dry

By L. M. LIMPUS
Superintendent of Reclamation
Oklahoma Gas & Electric Co., Oklahoma City

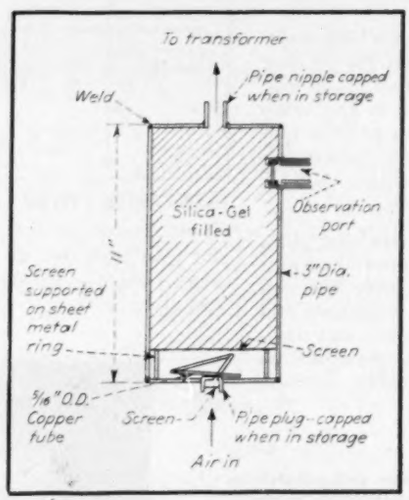
Large, free-breathing, spare transformers, some current transformers, oil storage tanks and similar oil-filled apparatus on the Oklahoma Gas & Electric Company system have been fitted with dehydrating breathers to keep the air in the gas space of these units as dry as possible. This is desirable since idle oil-filled, free-breathing apparatus or equipment operating at ambient temperatures is subject to more rapid moisture contamination than loaded units in which the temperature is well above ambient.

Both calcium chloride and silica-gel has been used as the moisture absorbing substance in these breathers. However, Cobalt-coated, 6/16 mesh silica-gel is preferred for this purpose since it will not cake and harden when saturated with moisture, it shows a distinct color change when saturated with water and it is easily reactivated.

Calcium chloride, in breathers of this type, deteriorates in from three to six months and cannot be reactivated. It also tends to form a solid plug in the breather, which not only obstructs the breathing but is likely to produce more condensation within the apparatus than open breathing. Restricted breathing tends to produce a throttling effect that contributes to condensation. For example, a partial vacuum within the apparatus, produced by a sudden rainstorm, pulls air past the breather, allowing it to expand suddenly as it enters the air space above the oil, with the result that water condenses out rapidly.



DEHYDRATING breather, filled with silica-gel, drys air entering idle oil-filled apparatus



CROSS-SECTION of dehydrating breather installed on idle transformers 200 kva. and larger

Telltale silica-gel when completely dehydrated is dark purple in color, and in this condition will absorb approximately 45 percent of its own weight of water from saturated air. It assumes a light blue color when it has absorbed about one-third its weight of water and is ready for replacement and reactivation. When the silica-gel is completely saturated it is a whitish-pink and it will absorb no more moisture.

Silica-gel is dried (reactivated) in about six hours at a temperature of 165 deg. C. (330 deg. F.). If it does not become saturated with insulating oil it will last almost indefinitely. In reactivating the gel the temperature should not be permitted to go beyond 600 deg. F. It may be reactivated at 250 deg. F., although this will take longer than at the temperature mentioned.

•

Boron-Ferroalloys Increase Hardenability

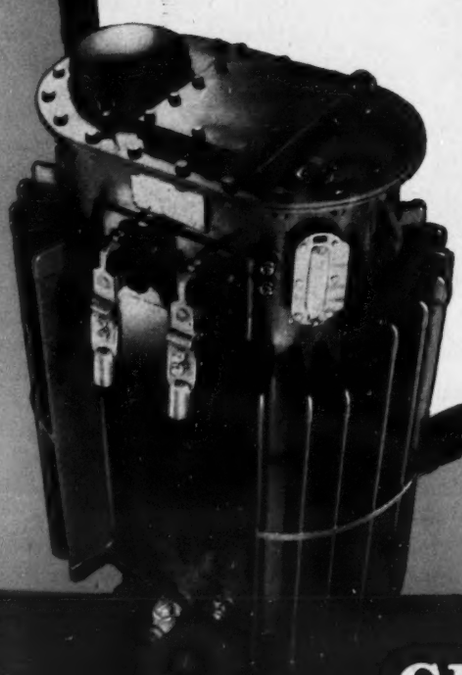
Certain ferroalloys containing boron, known as "special addition agents," possess the property of markedly increasing the hardenability of many steels when added in relatively small amounts. These alloys are also known as "needling agents" or "intensifiers." The additives offer promise of conserving critical alloying elements. By suitable adjustment of steel chemistry, these alloys can be used to replace important amounts of such elements as nickel, chromium and molybdenum.

These are some of the results that have been determined on the additive treatment of steel and outlined recently by R. B. Schenck, chief metallurgist, Buick Motor Division, General Motors Corporation, before the National Tractor Meeting of the Society of Automotive Engineers in Milwaukee, Wis. Nominal compos

Simplify transformer installations with PYRANOL all-purpose transformers

From the one fact that Pyranol* won't burn spring many benefits that would otherwise be difficult to obtain. Since you don't need expensive, fireproof vaults, you can install Pyranol transformers anywhere you wish—in the basement, on overhead beams, on the roof, or on the factory floor *at the center of the load*. Load-center distribution is highly desirable today, of course, because of the great savings in secondary copper that it makes possible. (Also, power losses are less and voltage regulation is 40 per cent better in the usual case.)

And whether the location you choose is indoors or outdoors, above ground or underground, wet or dry, clean or dusty, these *all-purpose transformers* will supply the power for your war loads with little or no maintenance.



***Pyranol** is the G-E trade name for askarel, a noninflammable, nonsludging insulating liquid. Ask your G-E representative for Bulletin GES-2974—the complete story for a safer plant. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

tion of a number of the currently available addition agents is listed in the accompanying table.

The general effect of additive treatment is to increase the hardenability and improve the mechanical properties of steel in the quenched and drawn state. In other than the quenched and drawn state the mechanical properties are lowered, at least in some steels.

Improvement in mechanical properties resulting from an additive treatment is confined mostly to the

Currently Available Special Addition Agents

Alloy Designation	1	2	3	4	5
Al	7.0	.....	10.0/20.0	13.0	.....
B	0.5	10.0/12.0	1.0/2.0	0.5	1.0/6.0
Ca	10.0	.....	.....	....	.....
Mn	.....	.....	15.0/25.0	8.0	.....
Si	35.0/40.0	3.0	20.0/30.0	....	40.0/45.0
Ti	10.0	.....	10.0/20.0	20.0	.....
Zr	4.0	.....	.....	4.0	.....
Fe	Bal.	Bal.	Bal.	Bal.	Bal.

plain carbon and low alloy steels, and this improvement is most pronounced at low draw temperatures of 300 to 500 deg. F. In sections which permit through hardening, treated SAE-1,000 and 1,300 steels will develop tensile and Izod values of the same order as those of the high alloy steels.

In general, it may be stated that, with respect to hardenability and mechanical properties, a carbon steel can be made equivalent to a low alloy steel and a low alloy steel equivalent to a high alloy steel by additive treatment.

The amount of additive required varies, depending upon the type of additive, the composition of the steel and the degree of deoxidation. Uniform melting practice is essential. Electric steel usually needs at least twice as much addition agent as open hearth steel to produce the same results.

Commercial applications of special addition agent steels were first made in the automotive industry; the steels being used in thousands of Buick motor car parts such as steering knuckles, arms and supports, transmission gears and main shafts, differential gears and axle shafts.

The work done by the Buick Division, General Motors Corporation, has been mostly on 0.20–0.50 carbon steels with four manganese ranges as follows: 0.70–1.00, 1.00–1.30, 1,35–1.65 and 1.60–1.90. Collectively, these steels cover an extremely wide range of properties and sections.

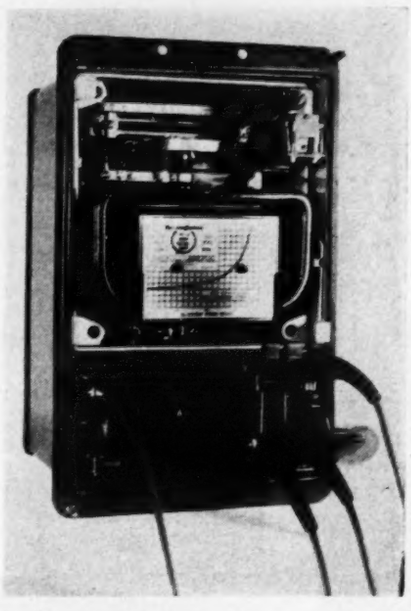
•

Combine Relay Case and Test Switch

By S. C. LEYLAND
Relay Engineer, Westinghouse Electric & Manufacturing Company, Newark, N. J.

Trend toward flush mounting of relays and meters on switchboard panels carries with it the problems of easy maintenance and testing. To be adaptable to different test and maintenance procedures used in the field, a combination relay case and test switch has been developed by Westinghouse engineers. It is possible to test the elements either in position or out of position, using plugs or conventional clip-leads to make the connections. The combination unit conserves panel space and simplifies switchboard wiring.

To accommodate the many relay and meter elements which must be



TYPICAL RELAY in a combination case and test switch; method of using clip leads to make test connections

mounted in the case, three sizes are available. The small and medium sizes are provided with ten test-switch positions and the large size has 20 test-switch positions. In the small and medium size cases the test switch assembly is located at the bottom of the case; in the large size case, a test switch assembly is provided at both top and bottom. The illustration shows a unit with the cover removed and the method of using spring clip-leads for making test connections.

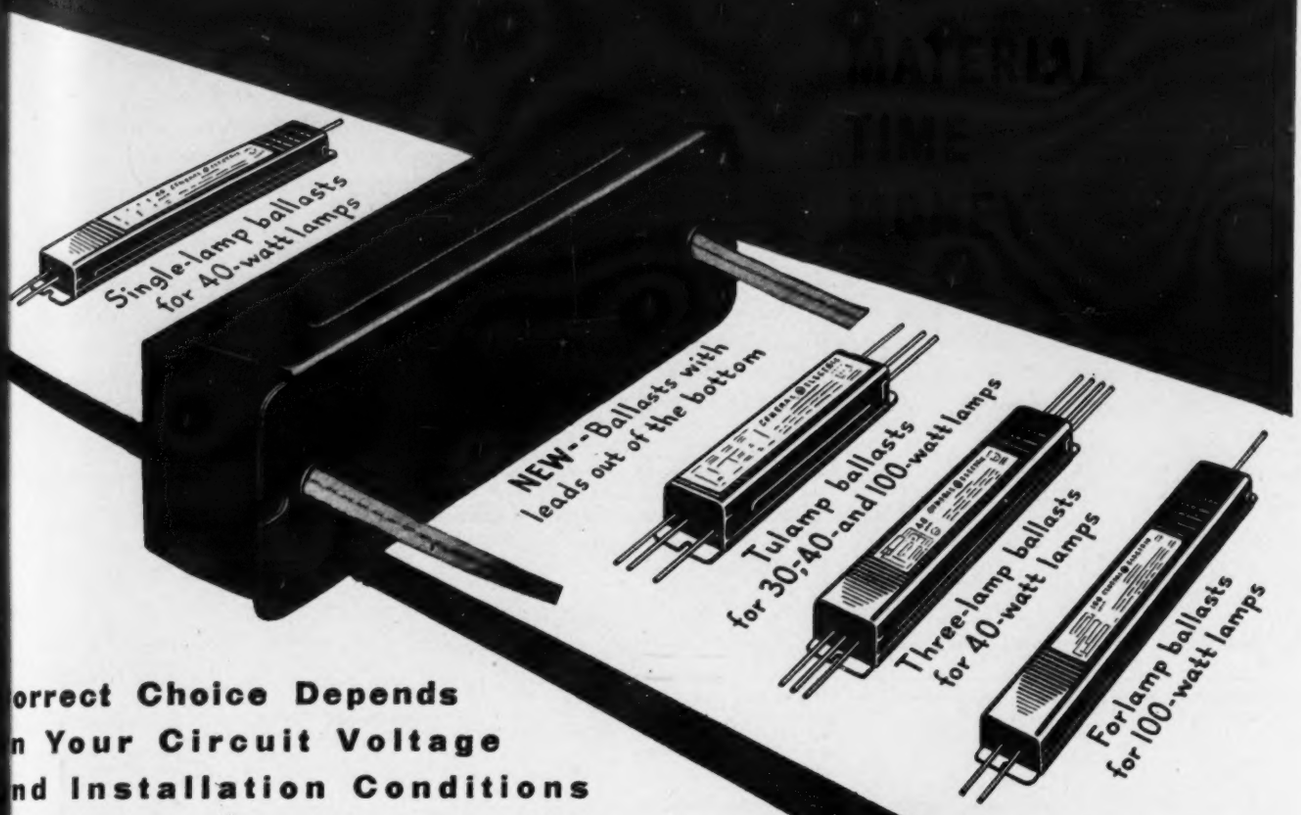
Test switches utilize knife-blade construction with movable blade and hinge jaw mounted on a molded block which is rigidly fastened to the case. Each hinge jaw is wired to a base terminal and base terminals are adequately spaced and arranged so that screws or studs may be used to connect the relay in the control circuit. The unit is mounted by means of four mounting screws (two at the top and two at the bottom) which are concealed when the cover is in position. The relay elements are permanently wired to the switch contact jaw, which is mounted on a molded block; this, in turn, is part of the removable chassis. With the chassis in position, connection to the elements is made through the switch blades. When the switch blades are open the relay elements are isolated from the secondary circuits for adjustment or test.

C.T. Short-Circuiting

Test switches used in the current circuit are provided with short-circuiting jaws to maintain the current transformer secondary circuit closed when the switches are open. In addition, a short-circuiting contact, mechanically operated by the chassis, is connected in parallel with the short-circuiting path of the switches; this functions to permanently short circuit the current transformer secondaries when the chassis is removed from the case. By using the switches and short-circuiting contacts in this way the danger of accidentally opening a current transformer secondary during maintenance and test periods is practically eliminated.

Slots are provided in each molded test switch handle for insertion of circuit identification cards; these may be marked in any desired manner. Holes are provided in the handles so that interlocking bars can be inserted to "gang" adjacent switches in various combinations. In addition the trip-circuit switch handle is identified by a red color; a transparent window in the cover permits easy observation of relay targets and inspection of relay elements. The frame which supports the removable element is constructed to provide easy inspection when elements are removed from the case.

For War-plant Fluorescent Lighting **CHOOSE THE G-E BALLAST THAT WILL**


Single-lamp ballasts for 40-watt lamps
NEW--Ballasts with leads out of the bottom
Tulamp ballasts for 30-40-and 100-watt lamps
Three-lamp ballasts for 40-watt lamps
For-lamp ballasts for 100-watt lamps

orrect Choice Depends n Your Circuit Voltage nd Installation Conditions

gle-lamp ballasts—The natural choice installations requiring but one mp per fixture; used most often in tricted spaces or where low levels of mination are sufficient.

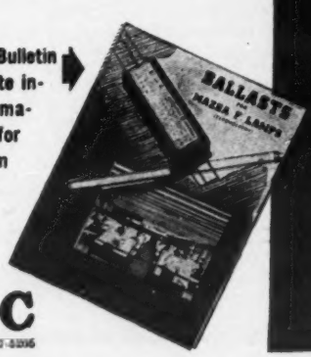
mp ballasts—Available for all lamp ings from 15 watts to 100 watts; serve materials in the ballast, uce light "flicker," cut electrical ses, require fewer fixtures for a en-sized installation.

e-lamp ballasts—Designed for use h 40-watt lamps on all circuits. You id use of two ballasts in one ure, simplifying installations and ing materials.

mp ballasts—For use with 100-watt ps on 265/460Y-volt circuits; a tural" for war-plant lighting; does work of two Tulamp ballasts of same rating, yet is the same sical size; in one aircraft factory installation, the use of Forlamp ballasts instead of Tulamp saved enough copper to make 95,000 cartridge casings (20-mm) and enough aluminum to make 111,000 fuse primers.

Ballasts with leads out the bottom—The most recent addition to the G-E line; available in 40-watt Tulamp and three-lamp ratings, 100-watt Tulamp and Forlamp ratings; developed as an aid to fixture manufacturers in saving critical materials; can be mounted completely exposed atop a shallow wiring channel.

WRITE TODAY for Bulletin GEA-3293 for complete information on G.E.'s material-saving ballasts for MAZDA F lamps from 4 to 100 watts. General Electric Company, Schenectady, New York.



GENERAL ELECTRIC

406-17-3296

BALLASTS FOR FLUORESCENT LIGHTING

HOW TO CORRECT TROUBLE ON SERIES-LIGHTING CIRCUITS

By GEORGE A. EDDY, Lighting Division, General Electric Company, Schenectady, N. Y.

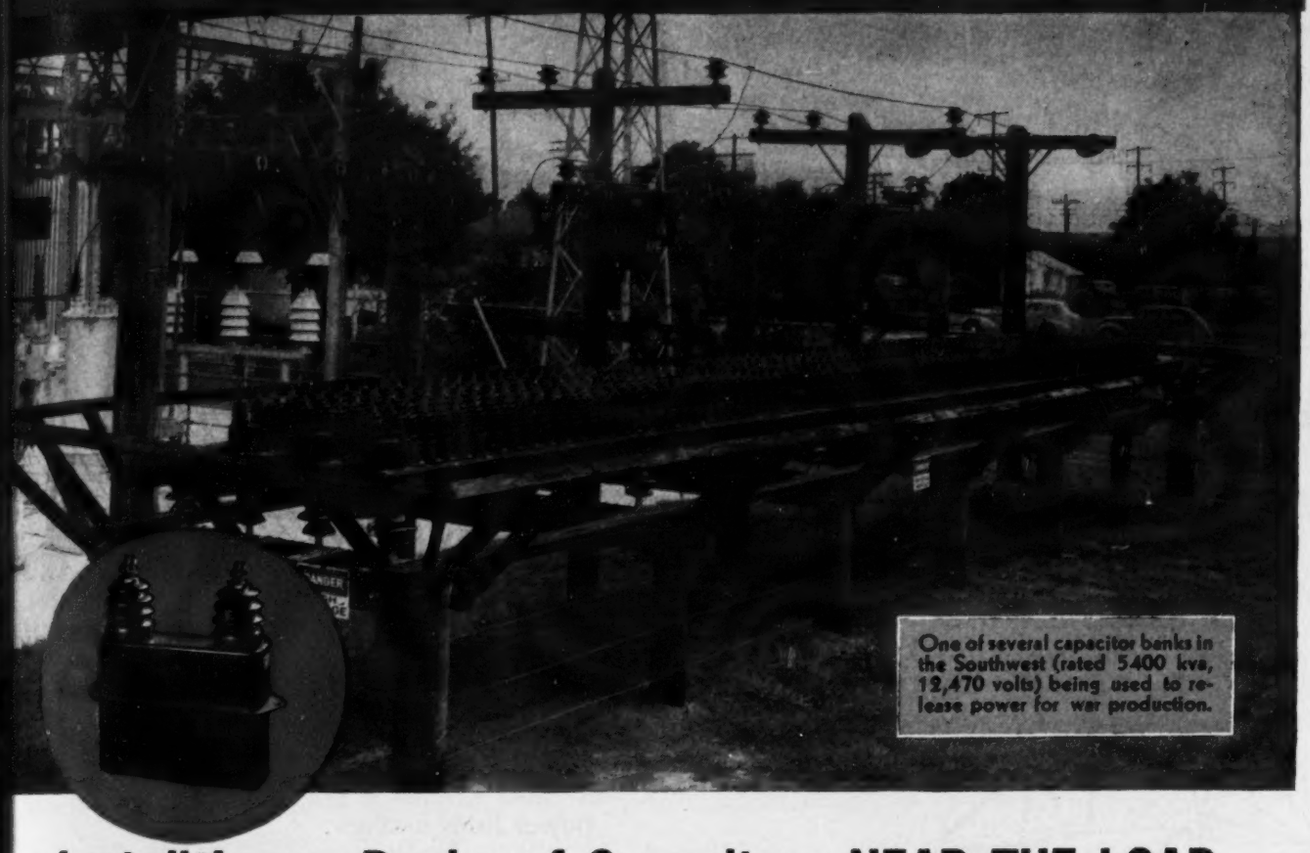
Accompanying trouble-shooting chart has been developed as an aid particularly for industrial maintenance men. Constant-current series-lighting circuits have different characteristics and use equipment different from ordinary power and lighting circuits; hence, any trouble that may occur is likely to be different from that ordinarily found on a multiple circuit.

Constant-current series have been used for years in street and highway lighting and have been dependable and economical. Public utility men, of course, have developed the know-how of installing and maintaining such circuits. However, such circuits are generally new to industrial plants, having been introduced mainly in connection with protective fence lighting since the beginning of World War II. The knowledge of where to look for causes of trouble, if it occurs, and what to do about them can be obtained by experience with the circuits on cold, rainy nights. But a great deal of that can be saved by use of the following table, which is based on a good many years of such experience.

Trouble-Shooting Chart—Series Lighting Circuits

Trouble	Cause	Remedy
Individual lamp out	Filament broken or burned out	Replace lamp and film cutout.
Lamp out but apparently O. K.	Lamp loose in socket	Tighten, and replace film cutout.
	Film cutout punctured	Replace; check to see that correct rating of cutout is used.
Lamps burn dim	Wrong type of lamp being used.	Replace with proper series-circuit lamp rated for circuit current.
	Circuit current low.	
	Power-supply voltage may be too low	Check voltage applied to constant current transformer; should be within 5 percent of nameplate rating.
	Constant-current transformer may be overloaded.	Check load on transformer; replace with larger transformer; remove some of the lamps or replace with lamps of lower wattage.
	Constant-current transformer may be out of adjustment.	If primary voltage is correct and transformer is not overloaded, readjust by moving balancing weights.
Lamps do not light	No current in circuit.	
	Feeder power may be off.	Check distribution substation.
	Fuse may be blown.	Install fuse of about three times primary current rating of transformer. If this size fuse blows, check transformer for short-circuited primary winding.
	Control power may be off.	Close oil switch by hand, and check control circuit.
	Series protective relay may have tripped.	Look for open circuit in series circuit; repair, and reset protector.
	Line switch or oil switch may have failed.	Close oil switch by hand; check control equipment.
	Series circuit may be open.	Locate and repair fault.
Lamps do not light—(*continued*)	No film cutouts.	Install film cutout of proper rating between prongs of each series socket.
Portion of circuit out	Film cutouts punctured.	
	Cutouts of wrong rating may be in use.	Replace with film cutouts of correct rating.
	Lightning may have induced a voltage surge.	Replace film cutouts. Additional lightning protection may be advisable if this trouble is frequent.
	Two or more grounds on circuit.	Repair grounded wiring using insulation adequate for circuit voltage.
Short lamp life	Wrong lamps in use.	Replace with lamps rated for circuit current.
	Current too high.	
	Moving coil of transformer may be jammed.	See that mechanism moves freely by hand.
	Transformer may be out of adjustment.	Readjust by moving balancing weights, check with ammeter and current transformer.
Lamps explode	Water dropping on hot bulb.	Check joints for leakage. Check slope of pipe bracket; should slope down pole at least 5 degrees.
	Bulb touches reflector or other part of luminaire.	Readjust lamp holder or repair luminaire.
Burned sockets and receptacles	Inadequate film cutout protection, possibly due to use of match sticks, tape, paper, or other improper material.	Use good film cutouts of proper ratings.
	Loose connections.	See that all connections are sound and tight.
Grounds inside luminaires	Improper wiring.	
	Insulation may be skinned back too far.	Rewire with insulation adequate for circuit voltage.
	Insufficient insulation may have been used.	
Wires broken off at terminals	Wire scored in skinning.	Reconnect wires.
	Wind sway and vibration.	Reconnect and install insulated supports or spreaders to anchor.

The Material-saving Way TO RELEASE SYSTEM CAPACITY *QUICKLY*



One of several capacitor banks in the Southwest (rated 5400 kva, 12,470 volts) being used to release power for war production.

Install Large Banks of Capacitors NEAR THE LOAD

ONE power company after another is taking advantage of this simple and quick ay of "clearing the wires" for more kilowatts. arge banks of Pyranol® capacitors are being ed all over the country to relieve transmis- on lines and generators of reactive kva and to prove low-voltage conditions.

ne reason why this method is so popular is at Pyranol capacitors are quickly available. so, they can be obtained and installed in a atter of weeks. And, most important, they quire *only a fraction of the critical materials* u would use to install new feeders and gen- ating equipment.

heir installed cost is low—well under $10 per kva. Maintenance and operating costs are negligible.

Remember, too, that standard 15-kva individual units can be mounted on temporary structures and later utilized for pole-line mounting on distribution circuits, if future system changes eliminate the need for a larger bank—a fact that adds immeasurably to the useful life of your investment.

Ask your G-E representative for his suggestions on the applications of capacitors in large banks. He'll be glad to help you with such problems as fusing, relay protection, and switching. Or write for Catalog GEA-2746B. *General Electric Company, Schenectady, N. Y.*

PYRANOL CAPACITORS

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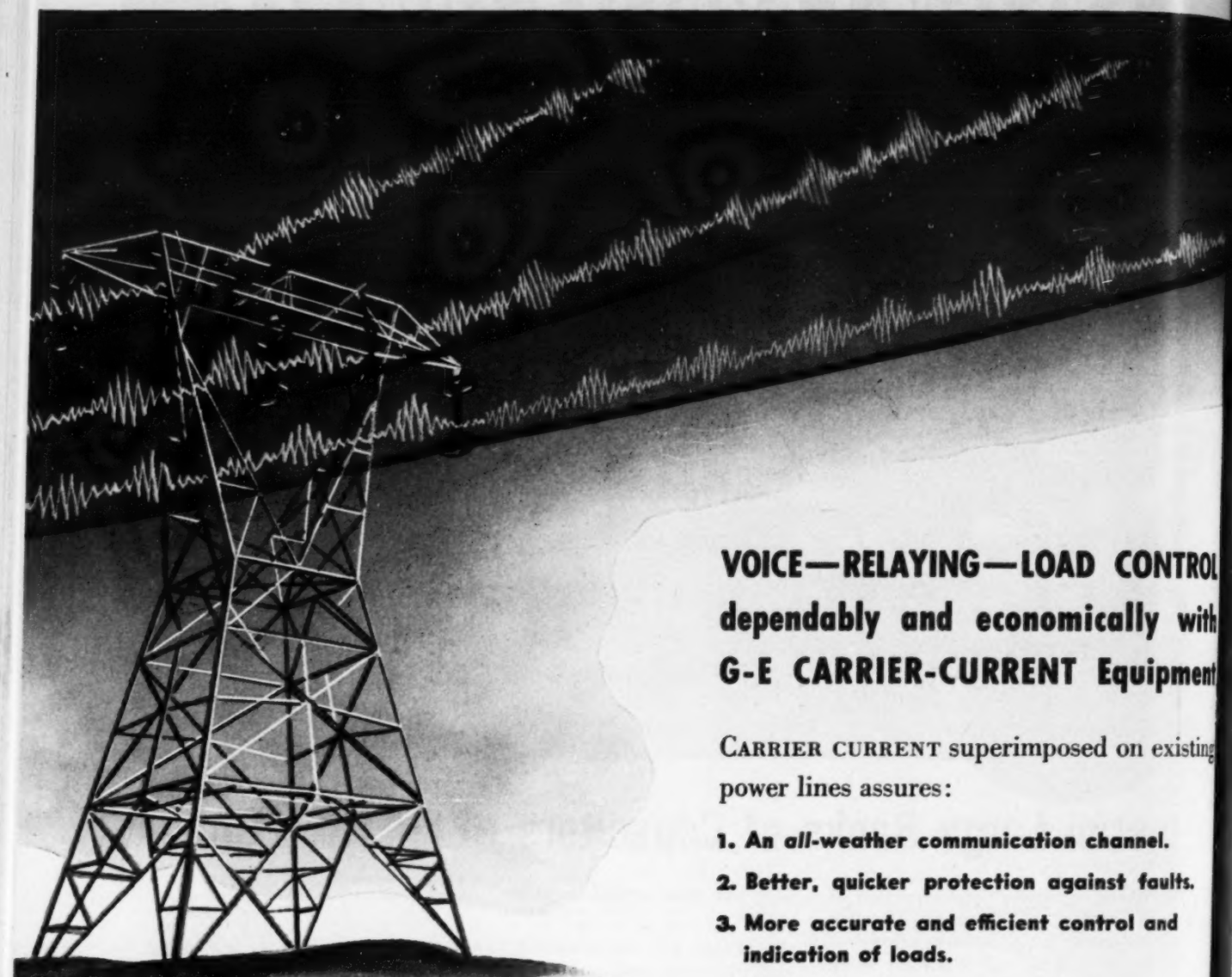
IS THE POWER LINE ITSEL



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CARRIER CURRENT superimposed on existing power lines assures:

1. **An *all*-weather communication channel.**
2. **Better, quicker protection against faults.**
3. **More accurate and efficient control and indication of loads.**

Today hundreds of G-E carrier-current installations, large and small, are providing the above and other advantages for power companies throughout the nation.

Pilot Relaying. Transferred Tripping. Signaling. Telephony. Telemetering. Super

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visory Control. Automatic Load Control. Line Sectionalizing Control. . . . Singly, in pairs, or in multiple combinations, these and other carrier functions may be installed to best fit the needs of your system.

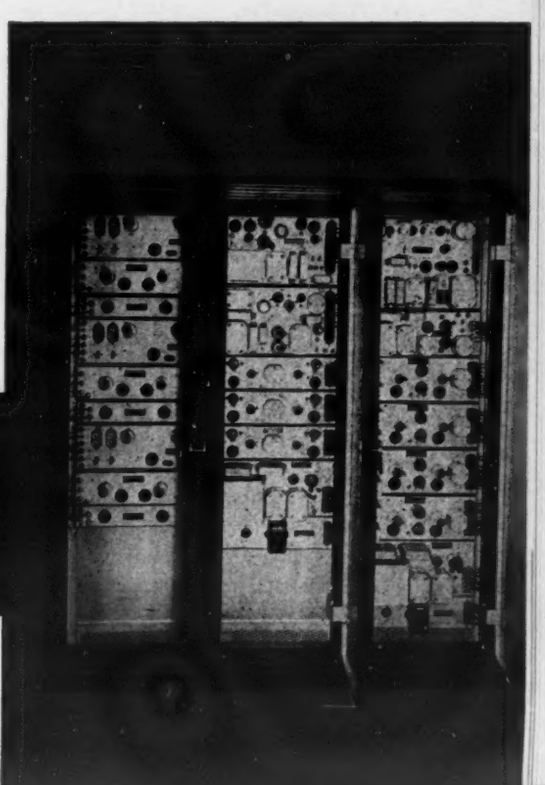
G-E standardized panel-unit assemblies permit step-by-step additions to original installations. Compactly "packaged," carefully built, thoroughly proved, they are capable of performing many functions through few carrier channels—all over one transmission system.

With the highest manufacturing standards, and the know-how of 20 years of research and development, G. E. offers the surest control facilities for better power service to the community.

General Electric engineers are prepared to discuss your needs—TODAY. . . . *General Electric, Schenectady, New York.*

• ***Tune in "The World Today" every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday listen to the G-E "All Girl Orchestra" at 10 P.M. E.W.T. over NBC.***

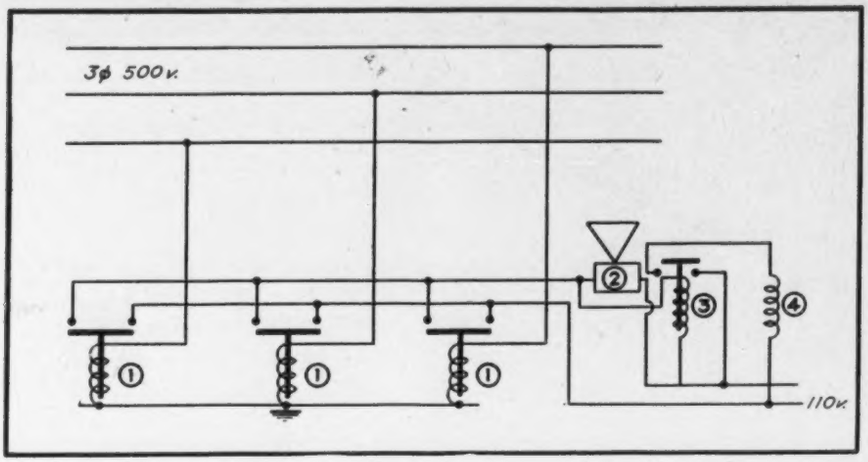
★ **BACK THE ATTACK—BUY WAR BONDS!** ★



GENERAL ELECTRIC HAS PLANNED AND BUILT MORE CARRIER-CURRENT EQUIPMENT THAN ALL OTHER MANUFACTURERS COMBINED

CARRIER CURRENT

THE NERVE NETWORK OF THE POWER SYSTEM



GROUND ALARM SYSTEM for quick attention. (1) Voltage relays, (2) horn, (3) two-minute time-delay relay, (4) breaker trip coil

Welder Circuit Ground Protection

By B. L. McARDLE
Electrical Engineer, United Steel & Wire Company, Battle Creek, Mich.*

Grounds on production welder supply circuits in which series capacitors are used must be quickly discovered and removed if erratic operation is to be avoided. With numerous welding transformers and associated auto-transformers connected and in the characteristic conditions of a production welding shop, grounds can be expected to occur fairly frequently. Therefore constant vigilance against them is necessary. The commonly used lamp detector has not proved satisfactory in these circumstances.

In the plant of the United Steel & Wire Company a three-phase, 500-volt, ungrounded system supplies a large installation of resistance welders. The ground detector used here was locally devised and it works well. As appears in the accompanying diagram, three voltage relays replace the usual lamps. The Y voltage holds all of these relay contacts open. Should a ground occur on any phase the associated relay loses potential and closes its contacts, energizing a loud warning horn and a time-delay relay set to close in two minutes. If the ground is not discovered and removed within that time the supply breaker opens, killing the circuit. The breaker is immediately reclosed so as not to interrupt production and another two minutes is afforded to find and clear the ground. Meanwhile the horn is complaining loudly at the delay. So effective is the alarm that four-fifths of all grounds occurring are found and removed within the initial two-minute period and the breaker does not open.

*Now in U. S. Army.

•

Home Built Cooler Ups Gear Capacity

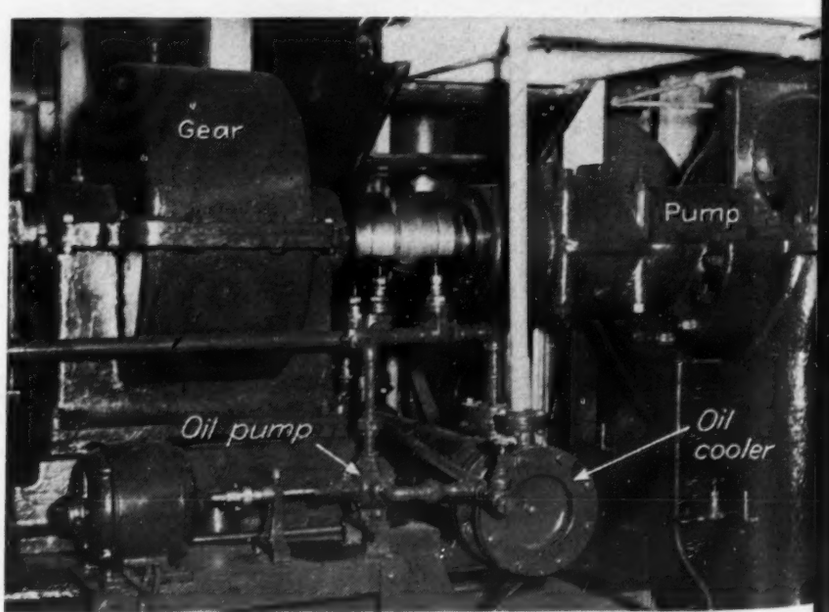
Ability to fabricate minor power plant apparatus from available material in stock has paid dividends to plant operating men more than once during the past year of priorities, delayed deliveries and heavy apparatus loadings.

One such instance concerns an oil-to-water heat exchanger built from available plant stocks of pipe, scrap tube and idle equipment to cool an overburdened reduction gear at Riverton station of the Empire District Electric Company.

The occasion arose when capacity of a turbine-driven circulating water pump was increased from 14,000 to 21,000 g.p.m. The turbine had ample capacity for the increase, but the oil-cooled, double-helical reduction gear interposed between the pump and turbine showed tendencies to overheat.

No heat exchanger of the type desired was available to meet the situation. However, plant machinists were able to build an entirely adequate cooler, of the type pictured, to do the job. A 36-in. length of 8-in. steel pipe, closed at both ends by flanges and boiler plate, formed the heat exchanger shell. Tubes, through which the cooling water is circulated, were salvaged from an old vent condenser and rolled in tube sheets at each end. An available ¼-hp. motor and 8-g.p.m. gear pump were requisitioned to circulate the oil from the reduction gear to the shell of the heat exchanger and back. Water for the tubes of the oil cooler is taken from the house service water system and discharged to the sewer.

The gear, which could not have continued to operate without a cooler, has operated for several months with this arrangement and will doubtless continue to operate with a home-built heat exchanger for the duration.

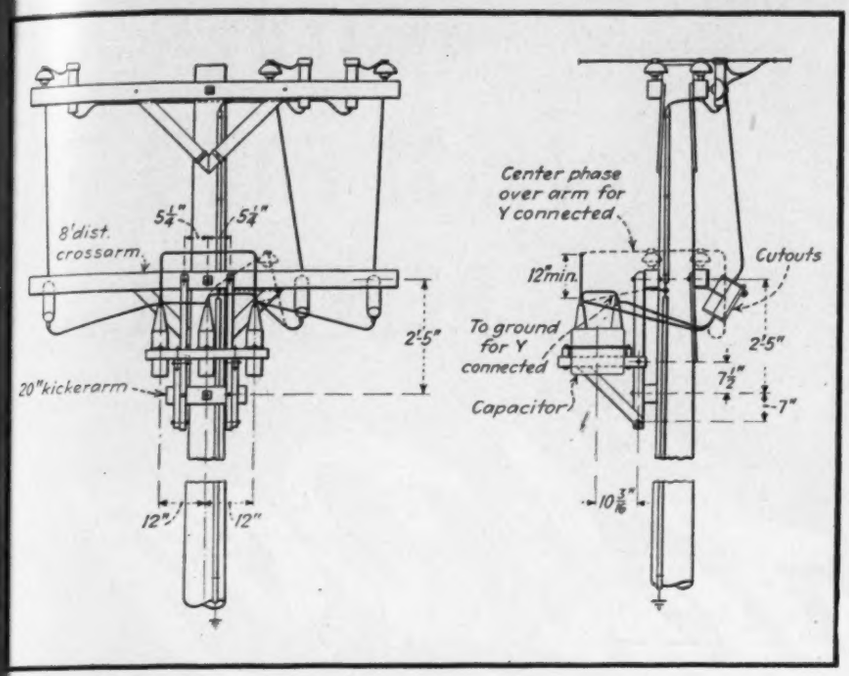


OIL-TO-WATER heat exchanger of the type improvised from available materials to cool overheated reduction gear

HOW TO CONNECT POLE-MOUNTED CAPACITORS

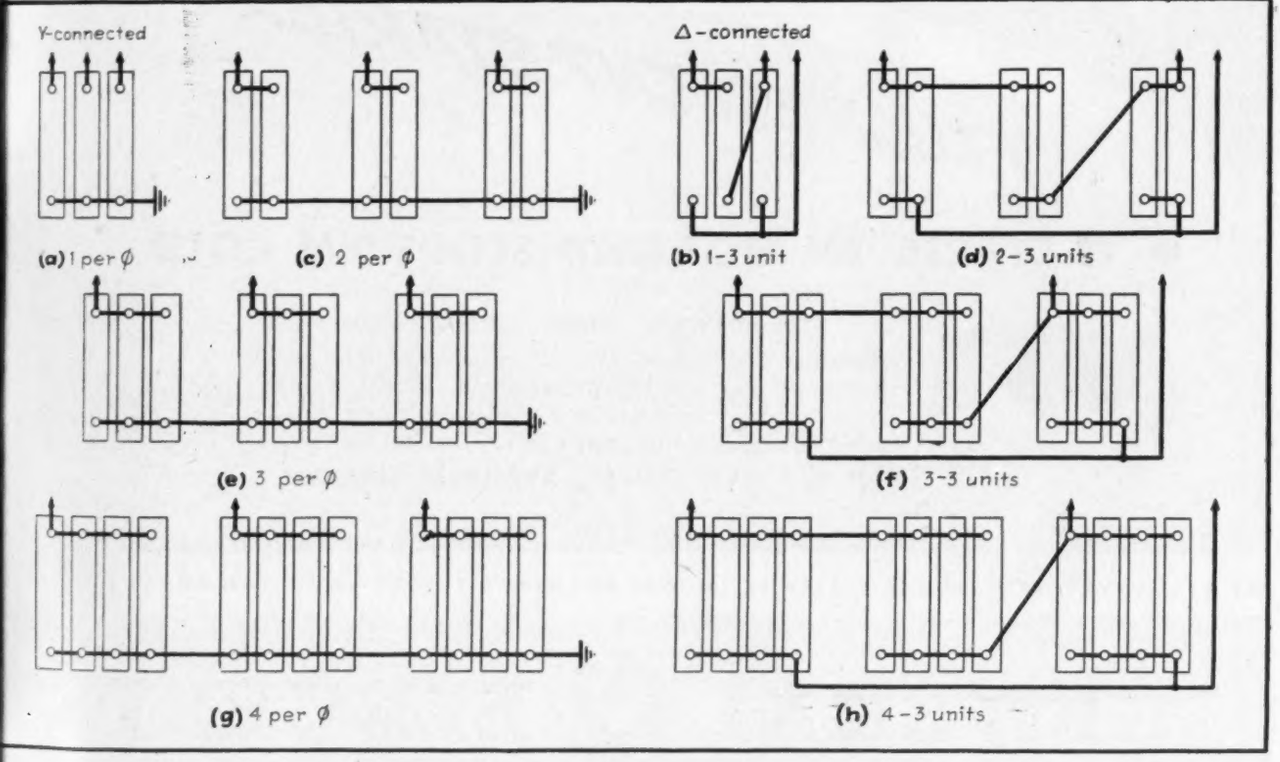
By EARL H. KENDALL
Commonwealth & Southern Corporation,
Jackson, Mich.

Electrical connections for individual and group units of shunt capacitors, as well as pole-line connections, adopted by companies of the Northern Division of the Commonwealth & Southern system. This is supplementary to data on construction of wood racks for pole-mounted capacitors given in ELECTRICAL WORLD, October 16, 1943 issue, page 86, and October 30, 1943 issue, page 84.



TYPICAL pole-mounted capacitor installation for 45 kva., three-phase, 2,400, 4,160 or 4,800 volts

SHUNT 15-kva. capacitors delta and wye connected to a three-phase circuit, for 45, 90, 135 and 180-kva. installations



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Shipments of the FS-40 Watch Dog starters can be made immediately to war plants, based on priority ratings. For example, a shipment for a plant with an AA-2x rating can be made promptly from Distributors' stock.

FOR 100-WATT LAMPS... AVAILABLE DECEMBER 1

THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE—BUY WAR BONDS

GENERAL ELECTRIC

AMAZING NEW G-E RESEARCH DEVELOPMENT MAKES FLUORESCENT LIGHTING MORE EFFICIENT THAN EVER

HERE are General Electric's latest achievements to make fluorescent lighting more efficient than ever . . . the G-E FS-40 and FS-100 Watch Dog fluorescent lamp starters. These new starters, the result of the combined efforts of the G-E Research Laboratories at Nela Park and Bridgeport, offer several outstanding advantages over standard starters:

1 **Prevents flicker** that slows up war production by annoying workers.

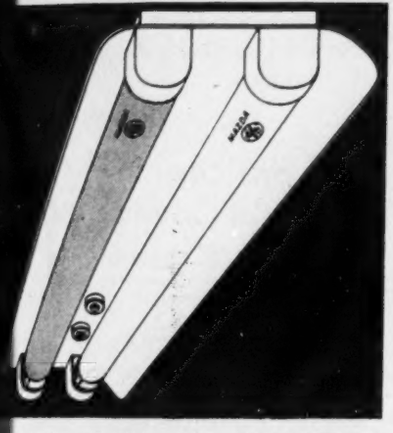
2 **Conserves electricity** by preventing burned-out lamps from being started needlessly.

3 **Increases life of fluorescent auxiliaries.** The average life of the new starter is equivalent to the life of ten 40-watt fluorescent lamps compared to two or three with standard starters (Under specified test conditions the Watch Dog outlasted an average of ten fluorescent lamps.) Ballast life is also lengthened.

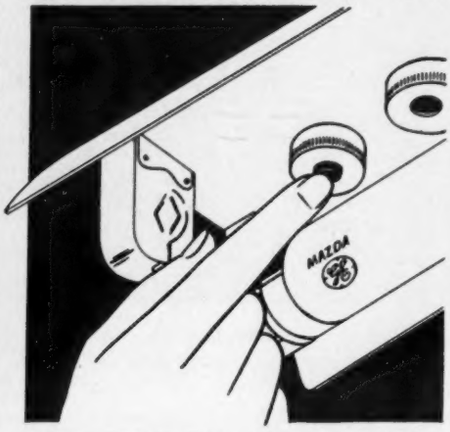
* * *

Distribution and sales of the Watch Dog starters are handled through the Appliance and Merchandise Department. For new Fluorescent Accessories Catalog write to Section GN-1136-F, General Electric Company, Bridgeport, Connecticut.

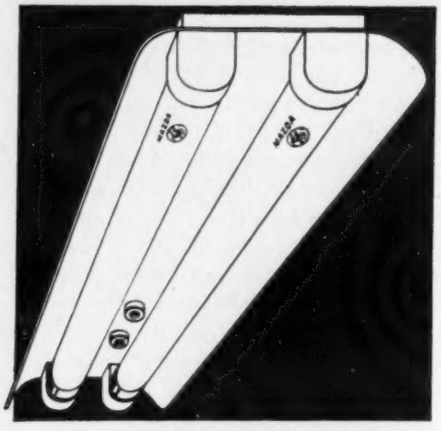
HERE'S HOW NEW "WATCH DOG" STARTERS WORK!



1 As lamp begins to die, the G-E Watch Dog cuts out. No flow of current trying to restart dead lamp means no flickering. Current is saved, ballast safeguarded, and starter life prolonged.



2 No "cooling" period required to reset starter when replacing dead lamp. It may be taken out at once. Starter remains in fixture and is reset by pressing button before new lamp is put in.



3 As soon as the new lamp is inserted, the General Electric Watch Dog starter brings the lamp into the circuit immediately.

General Electric Lamp Research is responsible for much of the good lighting that is speeding war production today. The never ending goal of that great research organization is to make General Electric lamps stay brighter longer.

MADE TO STAY BRIGHTER LONGER

Hear the General Electric radio programs: "The G-E All-Girl Orchestra," Sunday, 10 p.m. EWT, NBC; "The World Today" news, every weekday, 6:45 p.m. EWT, CBS.

G-E MAZDA LAMPS

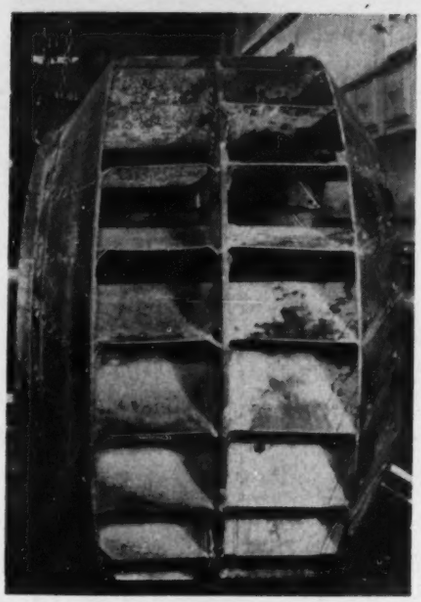
Temporary Repair Restores ID Fan

Gradual abrasion, over a period of years, by the fly ash that escapes the electrostatic precipitator at Cincinnati Gas & Electric Company's West End station eventually led to the pictured destruction of vanes and end plate on one side of an axial-inlet, radial flow, center-plate type induced-draft fan rotor. The rotor is 66 in. in diameter and driven by 350- and 800-hp. motors at 900 and 1,200 r.p.m.

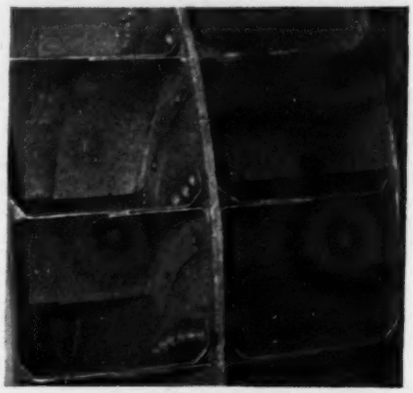
Failure at a time when a new rotor could not be obtained from the manufacturer led to a novel repair which permitted operation of the fan for six months at the 900 r.p.m. speed. And finally the entire experience led to the alteration of similar fans on the system, to prevent recurrence of the trouble.

Wear of the fan blades, which caused the failure, occurred along the bend where the relieved blade is turned and riveted to the center plate of the fan. The accumulated wear went unnoticed during inspection because the amount of wear increased gradually from a minimum at the leading and trailing edges of the blades to a maximum at the midpoint of the 12-in. blade width measured along the bend.

Failure occurred by tearing or shearing of the fan blades from the center plate as shown. Oddly enough, when the failure occurred the damaged portion of the rotor came away clean and did not foul the remaining portion of the rotor, which remained in balance and was operated for several hours after the failure.



FLAT PLATE BLADES and improvised end-plate kept fan in operation at reduced speed for several months till new rotor arrived



WEAR PLATES added to fan blades on both sides of center plate prevent recurrence of trouble

To permit the fan to continue in operation for several months, until a replacement could be obtained for the rotor, a temporary end plate in the form of a cone was made up and blades improvised from flat plate. These were fastened between the center plate and end plate with angles. The rotor was restored in this manner and operated at 900 r.p.m. for several months until a new rotor was shipped. Extra blades and a new end ring were also obtained to replace the temporary ones, thus providing a spare rotor for emergencies.

To prevent a recurrence of this trouble on other fans, $\frac{1}{8}$ x 6 x 12-in. plates conforming to the curvature of the blades were added on both sides of the center plate as shown. It is intended that these plates shall take future wear and be renewed as needed. The wear plates are welded to the fan blades and to a curved strip riveted to the center plate of the rotor. The right angle so formed detracts somewhat from the efficiency of the fan, it is stated, but not enough to be serious.

ABRASIVE WEAR at bend in ID fan blades traceable to fly ash causes half of blades to shear away at center plate

•

Mold Splices Synthetic Coverings

By F. P. REARDON
General Construction Department, Pacific Gas & Electric Company, Oakland, Calif.

Due to conditions imposed by the war, it is not possible to obtain rubber-covered wire or rubber tape for switchboard and interconnecting wiring. Pacific Gas & Electric Company now uses one of the well-known trade name synthetic insulated wires on the market. It is an excellent material, being flexible, flameproof and highly insulating. There has been some difficulty, however, in making splices, especially where used on underground services where a molded splice is much preferred.

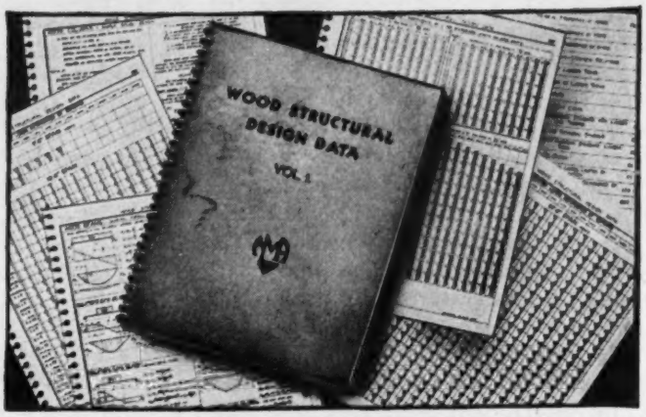
The manufacturer recommends that tape be used on splices and after application be covered with tin or lead foil to which heat is applied until the tape vulcanizes. In this method it is difficult to get exactly the right amount of heat, with the result that some parts of the splice are heated too much and other parts are sufficiently vulcanized.

To overcome this difficulty the

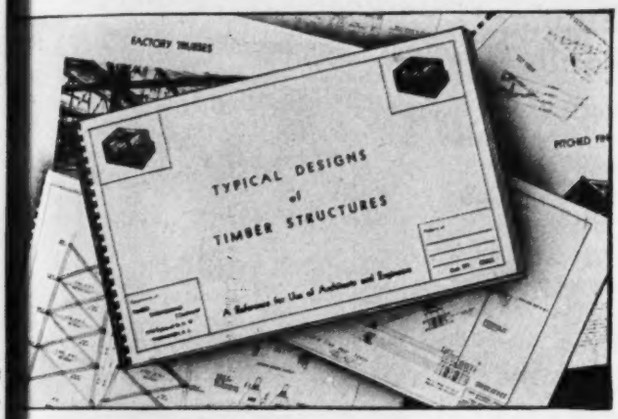
SERVICES TECO HAS FOR YOU

WHEN YOU BUILD WITH WOOD

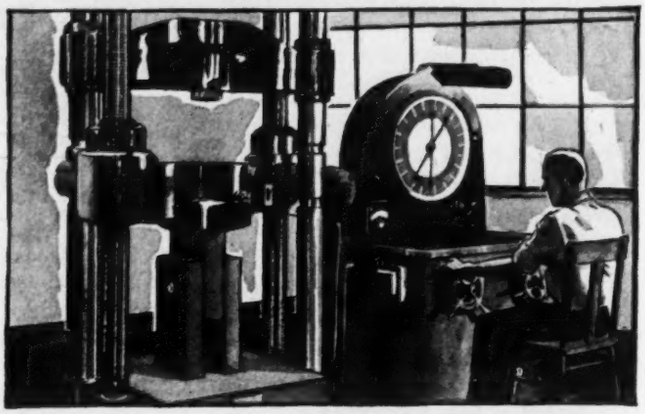
NSULTING SERVICE. Teco maintains a staff of engineers consult with architects and engineers on their design prob-ns. Teco Connector distributors and fabricators in all parts the country also render helpful services.



DESIGN DATA SERVICE. Teco has available for architects and engineers complete data on all phases of timber design, including tables and charts on timber beams, columns, floors, connector loads, bolt loads, stresses, etc.



YPICAL DESIGN SERVICE. "Typical Designs of Timber uctures"—a 100-page book—is available to architects and gineers free upon request. Copies of several hundred other igns of typical Teco Timber Structures are also available on quest.



RESEARCH SERVICE. Teco conducts a continuous research program through laboratories as well as sponsoring research at outstanding engineering colleges to increase the design knowledge of timber designers.

ood is often referred to as the *rediscovered* material, e to its development by science for plastics, lamina-ns and heavy construction.

Engineering science that developed the Teco Connec- System of timber construction is responsible for the sition timber occupies as a leading heavy construction terial.

The Teco timber system serves our war effort . . . it ll *serve you* in peace times too.

TIMBER ENGINEERING COMPANY
—Washington—Chicago—
Minneapolis—Portland.

The **TECO** *Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*

Specify
TECO
CONNECTORS
★ TOOLS ★

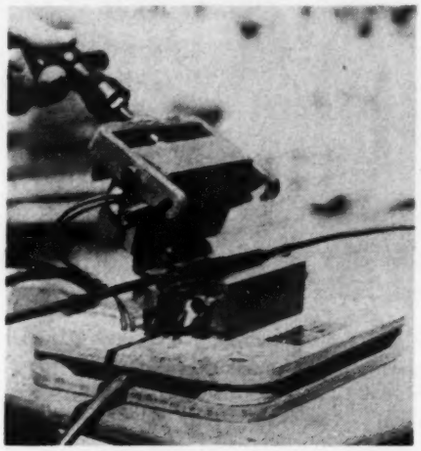
ENDORSED BY LEADING LUMBER MANUFACTURERS AND FABRICATORS

author designed a mold consisting of a two-part hinged copper block containing a split groove, into which the taped splice is inserted. The mold was then heated with a gas torch. In order to determine when the temperature was right an inspection hole was left in the block, through which the synthetic material could be observed and the flame properly regulated.

This mold worked fairly satisfactorily and the splice showed reasonably high dielectric strength. In each case, however, failure occurred opposite the pinhole. This indicated that better splices could be made if a more satisfactory method of regulating the temperature could be devised.

The company's bureau of tests and inspection was asked to make a similar mold, electrically heated and thermostatically controlled. The final mold, shown in the accompanying illustration, proved entirely satisfactory.

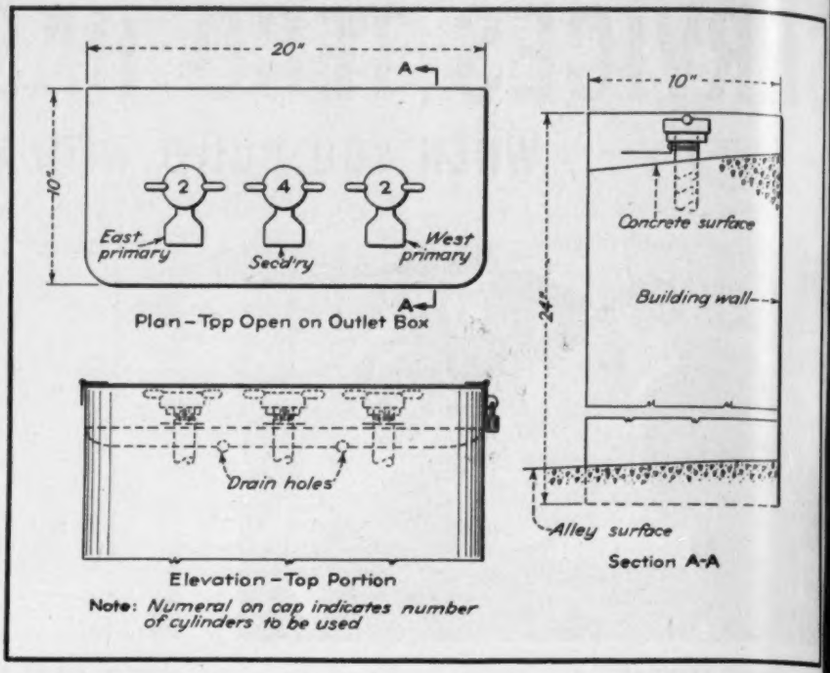
The splices are neat and have a dielectric strength of approximately 22,000 volts. Almost invariably failure occurs outside the splice, showing the splice to be better than the regular insulation.



ELECTRICALLY HEATED, thermostatically controlled mold for vulcanizing synthetic covered wire splices

Two 125-watt, cartridge-type heaters were used, one in each block. A cartridge-type thermostat inserted in one controls the temperature to 310 deg. F., within 0.2 of 1 deg. Weight of the mold is 15 lb.

This idea received first award in the 1942 suggestion contest of the company's research committee under the chairmanship of W. G. Vincent, vice-president and executive engineer.



ARRANGEMENT of typical CO_2 outlets through which gas is injected into network transformer vaults

Outside CO_2 Fittings for Network Vaults

Provision for fighting oil fires by injecting CO_2 gas from the outside into network transformer vaults in downtown Louisville hotels and office buildings has been made by the Louisville Gas & Electric Company.

Major vaults have been piped and nozzles provided to blanket all parts of such vaults with gas in the event of fire. Piping connections have been brought out to suitable metal boxes on the outside vault wall which house fittings for connecting interior piping with CO_2 gas bottles, carried on all fire department trucks.

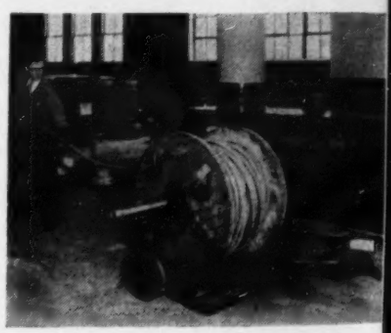
Piping terminals are male fittings normally capped and marked to show what vault compartment they serve and the number of gas cylinders required to take care of that compartment. These fittings take the female fitting on hose connections. By this arrangement it is possible for firemen or company employees to smother oil fires in the vault from the outside without opening vault doors and thus endangering themselves or the adjacent building.

Low temperature fuse links attached to dampers of ventilating fuses close off compartments in the event of fire and thus provide a maximum smothering action to the fire.

Boxes housing the piping connections are normally locked, but keys are in the possession of the fire department at all times.

•

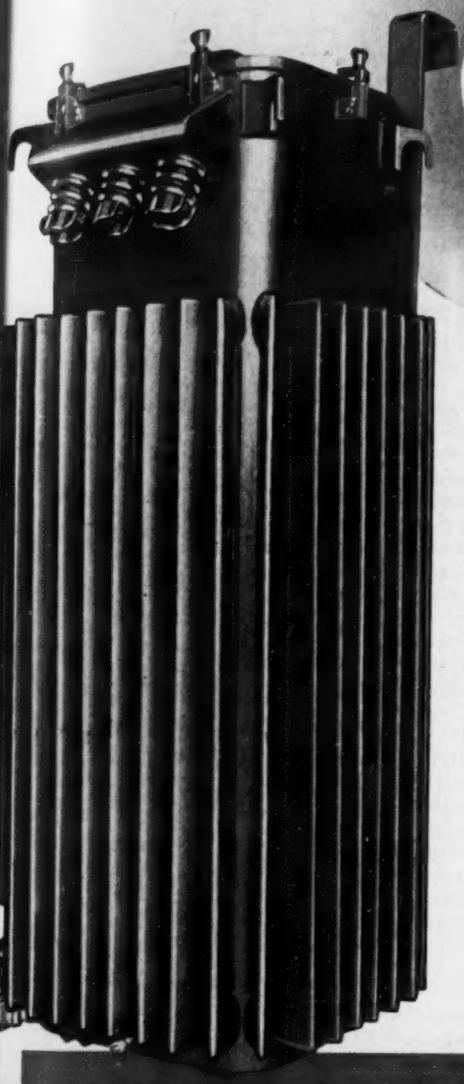
For Lifting Cable Reels



Feature of this hand truck for lifting reels so that cable may be paid off or rolled on is that it is adjustable to different reel diameters. The upright bars on each side are drilled with several holes so that movable dogs can be set at different heights. The truck was designed and is in use in the Richmond warehouse of the Virginia Electric & Power Company and, according to R. H. Wood, head storekeeper, has paid its cost many times in time saved.

The trend is toward

VERTICAL TYPE THREE PHASE TRANSFORMERS

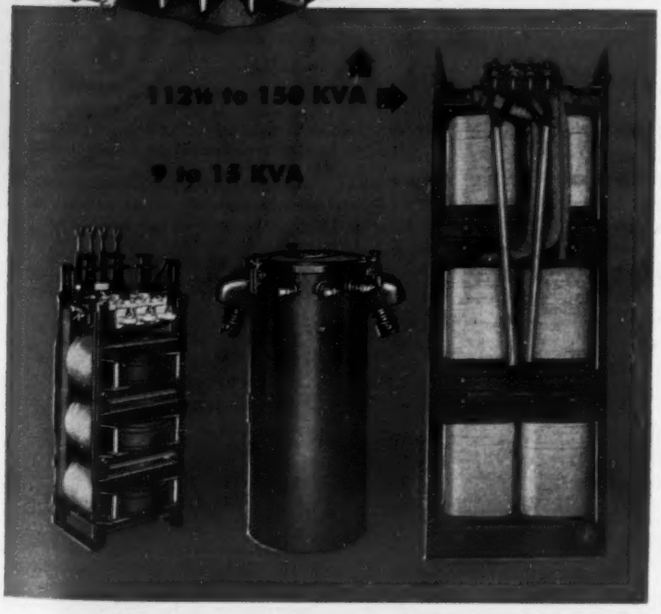


During the past five years, direct pole mounting of distribution transformers has become common practice because of the savings in installed cost and the improved appearance.

In 3-phase transformer installations this cost and appearance appeal is even more important and, in line with installation trends, L-M vertical type 3-phase transformers offer the latest development, measuring up to the L-M tradition of giving you more for your transformer dollar.

ADVANTAGES — With the neat, simple, on-the-pole installation, you greatly improve the appearance of your construction. In addition to the trim appearance, you also conserve space, so necessary in congested areas. And, last but not least, you effect appreciable dollar and cents savings on each installation which are of major importance on a system basis.

MOUNTING — All L-M vertical type 3-phase transformers meet the new EEI-NEMA standards for single phase transformers. Designed for direct-to-pole mounting, with their long "streamlined" design, the entire weight of the transformer is close to the pole, resulting in a safer installation.



ROUND-WOUND DESIGN — In sizes up to and including 75 Kva, L-M vertical type 3-phase transformers use the exclusive L-M Round-Wound core and coil unit with its inherent advantages of: improved regulation at all power factors — better ratio of losses — lower exciting current — higher impulse strength — improved cooling characteristics, resulting in longer life.

RATINGS — L-M vertical type 3-phase transformers are built in ratings up to 150 Kva, in voltages up to 13,200 volts. Beyond this range, L-M conventional type 3-phase transformers, incorporating round coils on stocked cores, are available in sizes of 100 to 500 Kva.

FULL INFORMATION — Before you invest in another 3-phase transformer, be sure to get the full, interesting story about the complete line of L-M Vertical and Conventional Type 3-phase Transformers in the L-M Bulletin No. 43161, profusely illustrated. Ask your L-M Field Engineer or write Line Material Co., 802 N. 8th St., Milwaukee 1, Wis., for a free copy.

LINE MATERIAL COMPANY

How to Determine Size of Slings and Sheaves for Rope Tackle

A method for determining the size of manila rope slings, sheaves and wood snatch blocks supplements "How to Determine Size of Rope for Tackle," presented in ELECTRICAL WORLD, October 16, 1943, page 104. This information is adapted from a book of standardized practices of the New England Power System.

SLINGS

Strength of rope slings used as the connection between the tackle and weight is of prime importance. The rope used should be of the best quality, to give satisfactory and safe service.

Size of pin, hook, eyebolt, or in fact anything to which the sling is attached, has direct relation to the strength of the sling. Slings tested over 3½-in. diameter pins developed 185 percent of the theoretical 200 percent; similar slings over 2½-in. diameter pins showed only 170 percent of the theoretical 200 percent.

Character of the splice used in joining the ends together also affects the strength of the sling. Maximum strength of a "short" splice may be stated as 90 percent of the strength of the rope. The percent loss from the full strength of the rope depends upon the ability of the splicer.

Tests made on slings passed around 2-in. diameter pins, so that two rope parts supported the pull, showed an average strength of 165 percent (1 2/3 times) the strength of the rope itself, instead of the 200 percent theoretically possible. Similar tests made on slings doubled and then passed around 2-in. diameter pins, so that the four rope parts supported the pull, developed an average strength of 325 percent (three times) the strength of the rope, instead of the theoretical 400 percent.

In using slings on heavy weights, consideration should be given to the angle of pull on the sling, due to the great effect it has on the efficiency of the rope, safety of life and material, and rope economy. Lack of attention to this factor may cause rope breakage and possible accidents. Sharp angles and sharp corners are too often responsible for the breaking of rope and consequent damage. An angle of 90 percent (see diagram) is a good practical angle to use with regard to tensile strength, centering of hook on purchase, general utility, and convenience in handling load.

The accompanying diagram illustrates the load put upon a rope used as a sling or lashing pulling at different angles. Note the rapid increase in stress on the sling at the larger angles for a given load. There is danger of life and property and an absolute disregard for rope efficiency and economy in the use of slings at angles more than 90 deg.

Condition and age of rope must be considered. If a rope has been used for some time, is not cut, has no signs of abrasive wear and no spots that indicate damage from acid or alkali, it should not be expected to develop its full allowable strength.

SHEAVES

Maximum stress on ropes is produced by the smallest sheaves or pulleys. Small sheaves, in addition to increasing wear on rope, increases friction. The size of sheaves and blocks as recommended by rope manufacturers is too often disregarded, resulting in the purchase and use of blocks too small for the diameter of the rope used. The best service is obtained by using a block as large as can be used, giving due consideration to position of tackle, speed of hoist and ease in handling.

The accompanying table gives recommended sizes of blocks for various sizes of ropes.

KNOTS

The necessity of using the proper knot for the job at hand hardly needs emphasis. An improperly tied knot will never do justice to the best rope and may cause damage to life and property. The only safe way is to see that the knot is carefully tied and that the rope is in a reliable condition.

(Editor's Note—For additional information on manila rope slings as well as safe loads for sisal and wire rope slings see ELECTRICAL WORLD, June 26, 1943 issue, page 85; July 24, 1943 issue, page 134; August 21, 1943 issue, page 92; September 18, 1943 issue, page 98.)

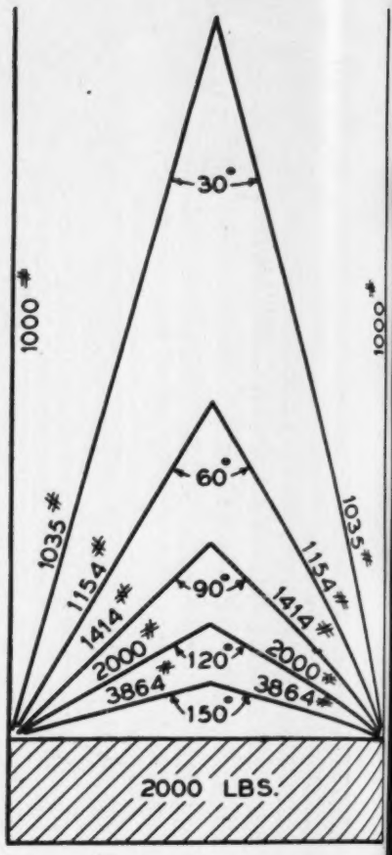


DIAGRAM shows increased stress placed upon sling due to angle of pull and the rapid increase at larger angles. Sling has not lost strength, but working factor of safety is decreased due to much greater stress set-up

Example: A factor of safety of 5:1 is desirable. To lift a weight of 2,000 lb. the load on the rope pulling straight up is 1,000 lb. on each. Referring to a table for strength of rope (*Electrical World*, October 16, 1943, page 104), which is based on a safety factor of 5:1, a rope ¾ in. diameter, 2¼ in. circumference (980 lb.) will be required. At an angle of 120 deg. the stress in the rope is doubled for the same load. The working factor of safety has been reduced to 2½. At 150 deg. it would be only 1¼. Hence, the importance of carefully considering the angle of the pull.

Sizes of Blocks for Various Sizes of Ropes

Size of Rope (Approx. Diam.), Inches	*Size of Block (Length of Shell), Inches*
Sheaves	
¾	3
⅞	4
½	5
9/16 to ⅝	6
¾	7
13/16 to ⅞	8
⅞ to 1	9
1	10
1⅛	12
1¼	14
1⅜	15
1½	16
1⅝	
Wood Snatch Blocks	
¾ to ⅞	6
1 to 1⅛	8
1¼	10
1½	12

6 good reasons why

-M HEAVY DUTY LIGHTNING ARRESTERS ARE ROTECTING MORE LINES THAN EVER BEFORE

HIGH SURGE CAPACITY

The special L-M valve composition will handle high-amperage and long-tail surges equally well.

LOW IMPEDANCE

Due to its characteristics, the L-M valve material holds internal resistance (IZ drop) to low values at all surge currents.

MOISTURE-PROOFNESS

Double "elastic" sealing at top and bottom, controlled production and thorough routine tests result in highest, permanent moisture-proofness.

PERMANENCE OF CHARACTERISTICS

L-M valve material is chemically and electrically absolutely stable, does not change its characteristics in operation, assures same unfailing operation, after years of performance.

VISUAL-INSPECTION GLASS BODIES

Glass bodies, exclusive with L-M Arresters (Pat. No. 2,165,964) permit easy inspection of Arrester condition at any time without costly laboratory or field tests.

THE ISOLATOR FOR FEEDER-LOCK-OUT PREVENTION

Any arrester might become damaged at some time in service. The L-M ISOLATOR will then save you time and money because it will automatically cut off the faulty arrester from the line, preventing feeder lock-out or phase grounding — Only L-M Arresters have the ISOLATOR. (Pat. 2,315,320).

Detailed information further explaining and illustrating these features and the reasons why they contribute to better service are fully covered in L-M Bulletin 40151. Write for it or ask your L-M representative for a copy.

LM

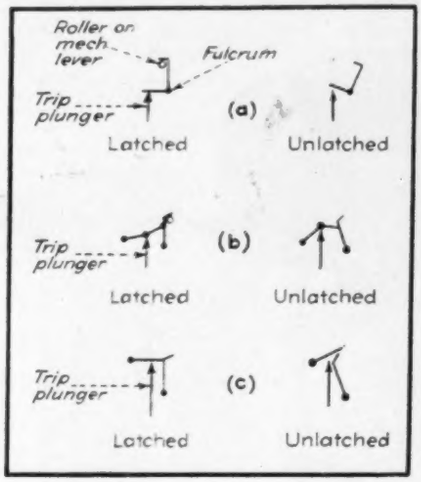
INE MATERIAL COMPANY

How to Close, Trip Circuit Breakers

8. Tripping Latches*

By G. J. EASLEY
Switchgear Engineer, Westinghouse Electric & Manufacturing Company

Numerous methods of unlatching have been used on operating mechanisms for circuit breakers; some of the more common forms are shown in the illustration. Part (a) shows a simple form of latch used on early models, which hooked over the roller (on mechanism lever) far enough to hold by itself. Obviously, the greater the hook on the latch to insure good latching, the greater the trip coil load. This latch has been generally superseded by the latches shown in parts (b) and (c) because they are faster and require less tripping energy. The latter are known as slip-off latches since they do not have enough hook to hold by themselves.



TYPES OF LATCHES used on circuit breakers

In part (b) a toggle arrangement slightly over center blocks the latch in place, the toggle being broken by the trip plunger. In part (c) a secondary latch or trigger blocks the main latch, the trigger being pushed off by the trip plunger. A further refinement of part (c) uses a triple latch arrangement; this adds another trigger (operated by trip plunger) to release secondary latch, which in turn releases the main latch. This is used only on very large breakers where latch load is high and high-speed tripping is required.

Toggle latch (b) is easier to manufacture and adjust than the latch in part (c); however, the latter is somewhat faster to trip, which is important on high-speed breakers.

Unlatching time for latch (a) is about 3 to 4 cycles, latch (b) 2 cycles, latch (c) one cycle, and as low as ½ cycle with the triple latch. The unlatching time is also affected by the type of trip magnet and strength of trip coil; the fastest times are obtained by using a laminated trip magnet.

The sketches in the illustration do not show how the latches reset when the breaker closes. This necessary feature has not been shown for the sake of simplicity.

Low Energy Tripping

Another means of unlatching is known as a "light trip" attachment and is used for various methods of low energy tripping. It is adaptable for overload tripping direct from bushing current transformers, for capacitor tripping, for undervoltage tripping, etc. Here the source of tripping energy is too small to operate the latches described above directly. Tripping is accomplished by allowing the trip coil to lift a small plunger that breaks a light toggle arrangement; this, in turn, releases the main trip plunger. The main trip plunger, driven by a compressed spring, trips the main latch, which may be any of those described above. The driving spring for the main plunger is reset automatically as the breaker opens.

The "light trip" attachment is usually arranged to take a maximum of four coils, any one of which may break the light toggle. It is necessary to apply four coils when three overload coils are used (one per phase) and one a.c. shunt trip coil is used for manual control switch tripping. The light-trip attachment adds a small amount to the tripping time since there are two latches to trip instead of one. For this reason it cannot be used where high-speed tripping is required, such as for 3- and 5-cycle breakers.

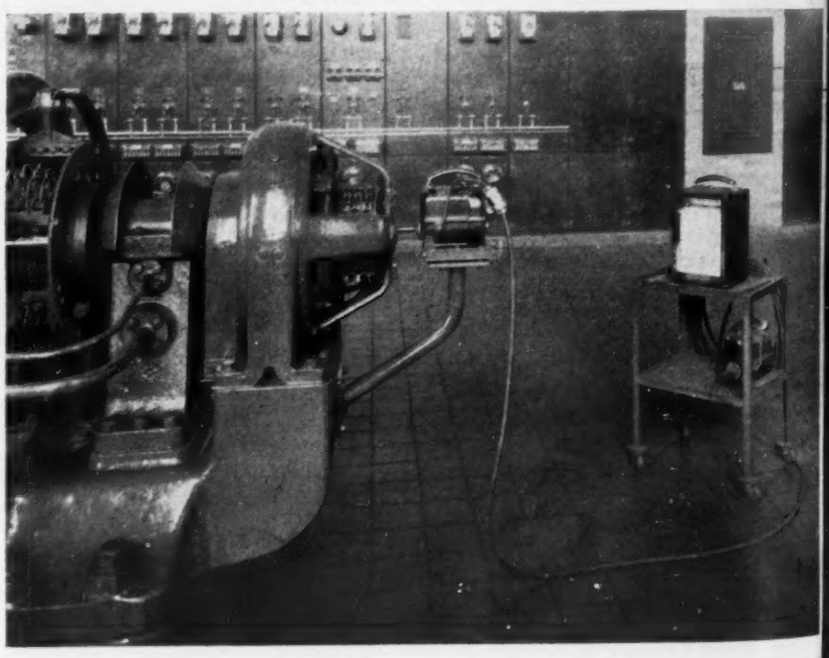
*Eighth in a series of twelve articles which began in August 7, 1943, issue of "Electrical World."

•

Tachometer Guides Turbine Starting

A d.c. electric tachometer and a recording voltmeter, calibrated in r.p.m., are used at the Ohio River station, Evansville, Ind., as shown, to guide turbine operators in bringing machines up to speed at a uniform rate, thus avoiding the dangers of non-uniform heating.

Two tachometers are used with the single recording instrument, one for 1,800-r.p.m. machines, the other for 3,600-r.p.m. turbines. When in use



PORTABLE dc. tachometer and recording instrument help in bringing turbine to speed at uniform rate

"What's Your Problem?"

says *Romey

"Our Representatives Are Still on the Job"

"Rome Cable representatives are still on the job. A call from you will bring one of these men to help you keep up-to-date on directives which regulate the use of cable in the electrical industry.

"Our boys know your problems. They live with them just like you do.

"It is this first hand information that has enabled us to put into Rome Cable products the stuff that has made them popular."

*Copr. 1943 RCC

FROM BAR TO FINISHED WIRE

ROME CABLE
CORPORATION
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★ ★ ★ ★ ★ ★ ★ ★ ★

More Hands Needed

★ ★ ★ ★ ★ ★ ★ ★ ★

Our all-important program of production for invasion is confronted today with a serious threat—manpower shortage. Many war factories in critical areas have exhausted their available supply of labor and are now directing their attention to the problem of conserving manpower.

Deltabeston Asbestos- and Glass-insulated Magnet Wires are helping war industries save many precious man-hours by reducing motor rewinding jobs to a minimum. Electrical maintenance crews are finding out that motors protected with Deltabeston Magnet Wires stay on the job longer in spite of continuous peak-load operations.

Deltabeston and Deltaglass Magnet Wires are designed for winding motors, lifting magnets, brake coils, generators, starters and other electrical equipment. They withstand high operating temperatures. Both are extremely flexible and can be formed into the most intricate coils. Deltabeston and Deltaglass Magnet Wires are available in round, square and rectangular shapes.

You can obtain additional information by requesting a Deltabeston Wire and Cable Catalog. It's yours for the asking. Write to Section Y1132-9, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn. G-E Deltabeston Asbestos- and Glass-insulated Wires are distributed by Graybar Electric Co., G-E Supply Corp. and other G-E Merchandise Distributors.

GENERAL ELECTRIC

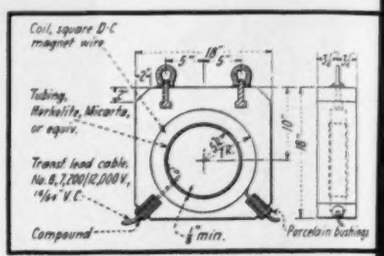
the tachometers are fastened by set screws to a pipe bracket bolted to the base of direct-connected exciters. A rubber-tipped shaft extension on the d.c. tachometer bears against the center hole in the exciter shaft.

When not in use the tachometer and instrument are stored on the instrument cart shown in the illustration. The bracket on which the tachometer is mounted is a permanent fixture on all turbines at the Ohio River station of the Southern Indiana Gas & Electric Company.

•

Reactor Design for Circuit Reclosers

Special concrete-incased current-limiting reactors of the type shown have been designed by the Kansas Gas & Electric Company, Wichita, for pole mounting adjacent to outdoor type 2.3-15-kv. oil circuit reclosers rated 12 to 50 amp. used on the company's 7-kv. system. Purpose of the reactors is to limit fault current


Coil, square D-C magnet wire
Tubing, Herkolite, Micarta, or equiv.
Transf. lead cable, No. 8, 7,200/12,000 V, 14/64" V.C.
Compound
Porcelain bushing

SPECIAL current-limiting reactor for use with outdoor oil circuit reclosers limiting fault current to values within reclose rating

through the reactors to a value that the reclosers can safely interrupt.

The reactor coil, which is incased in concrete for weather protection, is constructed of square, double-cotton-covered, enameled magnet wire wound on micarta tubing 10 in. inside diameter and 2¼ in. long, in layers 2 in. wide. The wire is passed through a bath of insulating varnish as it is wound. Reactor leads, consisting of No. 8 transformer lead cable insulated for 7,500 volts, are connected to the coil ends. The coil so prepared, is bound over all with cotton tape, dipped in varnish and baked. After baking, coil leads are computed in transformer-type bushings and the coil and bushing assembly cast in vibrated Haydite con-

CAN MOSINEE IMPROVE OUR PROCESSING BY MAKING SCIENTIFIC AND TECHNICAL STUDIES OF OUR PROBLEMS?
YES! THAT'S HOW MOSINEE CREATES SPECIAL PAPER FOR UNUSUAL REQUIREMENTS INVOLVING BOTH USE AND PROCESSING!
WHAT ARE YOUR PROBLEMS?

THESE CHARACTERISTICS WERE REQUIRED IN A PAPER

1 — High tensile strength; 2 — Excessive bulk; 3 — Accurate caliper; 4 — Pliability; 5 — Controlled absorption; 6 — High tear resistance.

- - and MOSINEE made it!

Have you considered how changes in certain physical properties of the paper you are using might improve your *processing* schedule, reduce production costs, and increase preference for your products?

Paper sometimes is the *obvious* cause of difficulties in processing. Mosinee engineers solve many difficult problems promptly. There are many instances, however, where no tangible "trouble" exposes itself, but where a thorough technical study of the paper and its relation to processing will result in higher speed production.

Whatever your situation may be, consultation with the Mills of Mosinee should bring practical answers.

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. B"

"America's Electric Utilities are helping their customers make FOOD FIGHT FOR FREEDOM"

Morse Salisbury

No. 8 IN A SERIES

Spotlighting six of the many utilities who are already aiding America's Nutrition Program

MORSE SALISBURY,
DEPUTY WAR FOOD ADMINISTRATOR

Philadelphia Electric Co.

MEN WHO DELIVER MILK FOR ABBOTTS' DAIRIES, PHILADELPHIA, THRIVE ON H-FOR-V MEALS
No better proof than this picture could be given that the H-for-V program keeps milkmen in top condition for their strenuous work.

Food fights for freedom! That's the battle cry of the War Food Administration which, in its current food program, is urging civilians to "Produce and Conserve, Share and Play Square".

And many utilities are doing an outstanding job on the Food Front. Their promotional and home economics facilities have been mobilized to educate the public on how to conserve food, and how to serve nutritious meals in spite of food shortages. This aids the war effort, because it helps worker efficiency and health, which in turn speeds war production.

If you have not yet launched a nutrition program, we urge early consideration of such a patriotic activity. A healthy America is a strong America, and our job is to keep it strong.

For example, over 1300 war plants and other organizations are now using the Health-for-Victory nutrition program, and in many of these plants the program is receiving the active support and sponsorship of the local utility. This program is flexible, and can be developed locally around the H-for-V Meal Planning Guide—a monthly 68-page book on wartime eating for health. It can be readily adapted to fit any local requirements.

Electric utilities are invited to use Health-for-Victory to help make Food Fight for Freedom. It is immediately available and fits perfectly into the plan recommended by EEI and the Council of Electric Operating Companies for co-operation with the government's food program.

Health-for-Victory

Duquesne Light Co.

UTILITY MAKES H-FOR-V BEGIN AT HOME —RIGHT AMONG ITS OWN EMPLOYES
Picture shows preparation for the mailing of Meal Planning Guides to approximately 5000 Duquesne Light Company employes.

SHARE-THE-RIDE PLAN GETS LA CROSSE, WISCONSIN, H-FOR-V CLUB MEMBERS TO MEETINGS
These loyal H-for-V members of the Northern Engraving & Mfg. Co. H-for-V Club team up and share the available cars.

Northern States Power Co.

Pennsylvania Power Co.

H-FOR-V MEAL PLANNING GUIDE HELPS UTILITY FAMILY BUY FOOD WISELY
The L. B. Harts are just one of the families of the Pennsylvania Power Company H-for-V Club which practically live by the Meal Planning Guide.

Western United Gas & Electric Co.

Hartford Electric Light Co.

ELGIN, ILL., ASSOCIATION OF COMMERCE SPONSORS ACTIVE H-FOR-V CLUB
This large and eager audience turned out to learn about H-for-V methods of making the most of the meat available for civilian use.

INSURANCE-MINDED HARTFORD, CONN., HOMEMAKERS REGARD H-FOR-V AS HEALTH INSURANCE
Patriotic members of H-for-V Club in this insurance center are insuring the health of their families by regular attendance at Club meetings.

CONTRIBUTION
AMERICA'S
R EFFORT BY

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

3 Electrical Huskies

to handle every light and power job

BUStribution DUCT for Flexible Power

Built in standard, interchangeable 10-foot sections, BullDog BUStribution DUCT provides *complete flexibility* for power and lighting circuits — enables you to change production lines at will—rearrange whole departments without interrupting production elsewhere.

BUStribution DUCT is an integral part of the machines it serves. It is quickly and easily installed—100% salvable.

(Conforms fully with WLB Limitation Order L-273)

INDUSTRIAL TROL-E-DUCT for Feeding Portable Tools

With Industrial Trol-E-Duct, the source of power moves along with the tool—cutting operating cost, eliminating interruptions due to fixed plug-in points, increasing both safety and productive time, and making extensive savings in wiring and other fixed equipment.

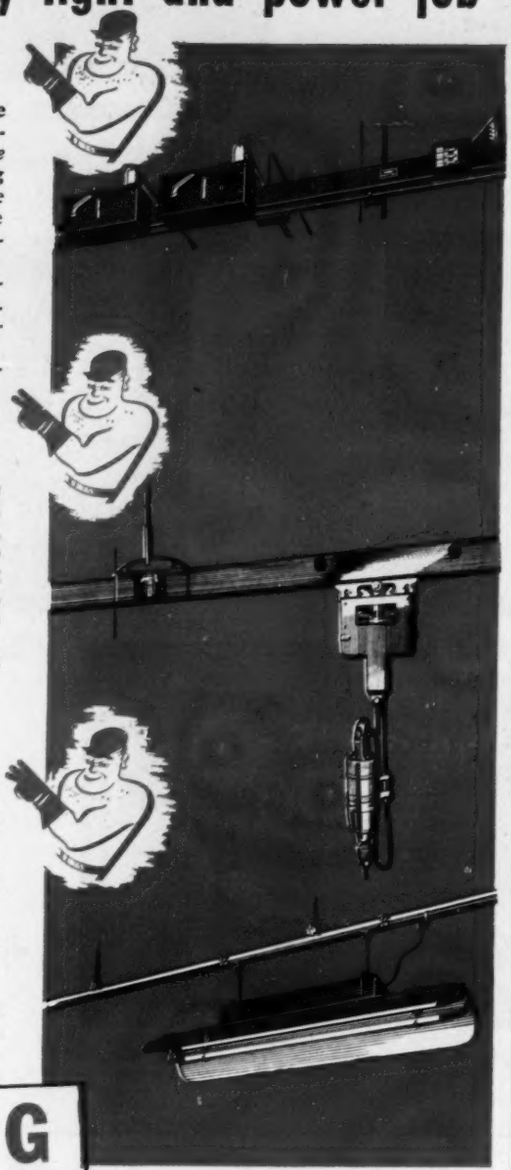
A fully descriptive bulletin will be sent on request.

UNIVERSAL TROL-E-DUCT for Flexible Lighting

What Industrial Trol-E-Duct is to power, Universal Trol-E-Duct is to lighting — a flexible system of quickly *movable outlets.*

Universal Trol-E-Duct puts light where it belongs — close to the work. It enables you to meet instantly any change in your lighting set-up or requirements, simply by moving lights along the duct or by adding new lights where needed.

Ask for full information about these and other BullDog products.



BULLDOG
ELECTRIC PRODUCTS CO.
Box 177, R. Pk. Annex
Detroit 32, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUStribution SYSTEMS.

You SAVE What You SPEND for WAR BONDS

crete, subsequently being coated with waterproof cement paint.

Reactor current ratings, wire size and number of turns for each rating are as follows:

Reactor Rating	Turns	Wire Size
50 amp., 2.68 ohms	138	No. 6 sq.
25 amp., 8.68 ohms	243	No. 9 sq.
15 amp., 17.28 ohms	343	No. 11 sq.

In making the connection between the inside end of the magnet wire with the reactor lead care should be taken that the connection is made at the point where the winding was begun. The inside end of the magnet wire should not be allowed to extend up along the side or across the top layer of the coil to the point of lead connection.

The completed reactor, which is 18 in. square, 6½ in. thick, is suspended with eye-bolts from the crossarm supporting the oil circuit recloser to which it is connected. Reactors of this type have been used on the system of the Kansas company for approximately four years with completely satisfactory results, company engineers report.

•

Use of Nylon as a Plastic

Generally thought of as a synthetic fiber and bristle material, actually nylon has always conformed to a common definition of a plastic—a material which can be formed to a desired shape under heat and pressure.

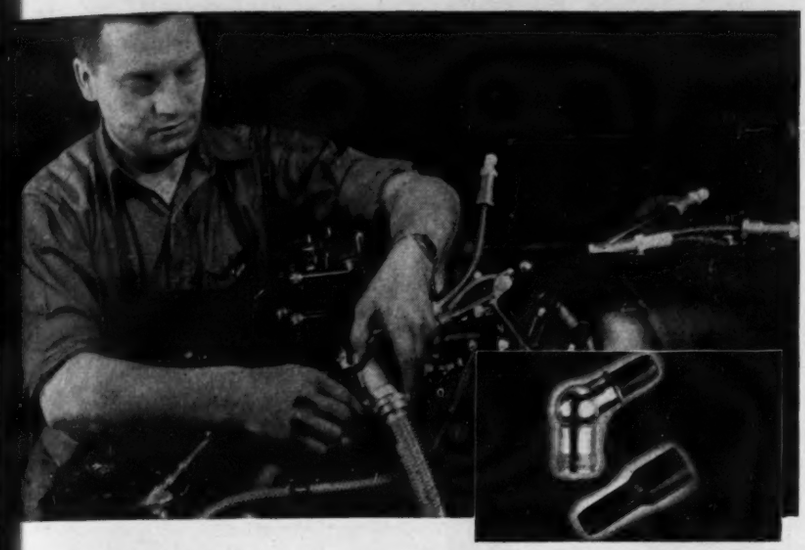
Nylon plastic is characterized by the highest service temperature and the greatest toughness of any plastic of equal rigidity and it is particularly useful for thin molded sections, according to the plastics department of E. I. du Pont de Nemours & Company, Arlington, N. J.

A Thermoplastic

Nylon is a thermoplastic, which means that under heat and pressure it can be reshaped and reformed a number of times. The yield temperature for most thermoplastic materials is low, about 150 to 200 deg. F., while nylon's yield temperature is 450 deg. F. Nylon articles retain form stability to 350 deg. F.

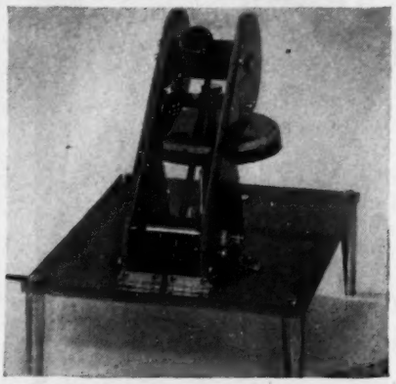
Thermosetting materials, the other fundamental types of plastic, cannot be remolded once they are formed under heat and pressure, even though heat sufficient to char the material

LIFE ON THE PLASTICS NEWSFRONT



(Above) **HIGH HEAT RESISTANCE** is a primary characteristic of aircraft engine harness parts molded of Cyanamid's mineral-filled MELMAC*. The compound used for the elbow liner and sleeve shown in the inset not only has the required dielectric strength (430 volts/Mil.) and arc resistance (A.S.T.M. avge. 130 sec.), but will withstand temperatures up to 400° F. Further information on Cyanamid plastics is available on request.

(Above) **ARC RESISTANCE** of "mixed" plastics is tested by the Rim Arc Tester.



(*Above*) **ELECTRODES** touch the rim of the plastic as it revolves on a turntable.

NEW ARC RESISTANCE TES.

In addition to the standard A.S.T.M. te... D 495-42, Cyanamid regularly submits sample plastic moldings to a "Rotary Arc Test" for arc resistance, which was recently developed in its Research Laboratories. As this test may be of interest to users of plastics in the electrical field, it is presented here in some detail.

Spots "Premature" Breakdowns

Realizing that some moldings may contain definite areas which have poor arc resistance, particularly if there is a blending or combination of resins used, various expedients were tried which would combine increased severity of test with the ability to explore an area of molded surface corresponding to a large number of spot tests of the A.S.T.M. type. The Rotary Arc Test was found to avoid too lengthy a test procedure, yet provide the most satisfactory answer to this problem. From the results of a large number of tests made both with the A.S.T.M. and Rotary Arc methods, it seems apparent that the latter test supplies a measure of the frequency of occurrence of "premature" breakdowns, i.e., areas of low arc resistance.

In the Rotary Arc Test, a molded piece is employed which may be described as a flat-bottomed 4-inch diameter disc with a ½-inch rim around the edge. The intersection of the rim and bottom is rounded to a 5/32-inch radius on the outside. The thickness of the molding is about 0.0075-inch.

Testing Apparatus

The testing apparatus consists of a turntable capable of rotating at 2/3 R.P.M. and a pair of pointed electrodes touching the sample, one above and one below the rounded juncture of the rim with the bottom of the sample. The electrodes are those normally used for the A.S.T.M. test and are tipped with a tungsten point similar to a lead pencil.

Although the constants of the A.S.T.M. test are maintained as far as possible, the use of a continuous arc was found desirable, so no timed interruption mechanism was used. To perform the test, a sample is placed over the turntable; the points are brought into contact with the rim; the turntable motor is started; and the arc switch is thrown. Whenever the material breaks down and conducts, the arc switch is shut off for a few seconds until the carbonized path has moved by, and then turned on again.

Test Conditions

A set of conditions has been established for this test as being an adequate measure of the quality of the molding material. These consist of:

1. A maximum of 10 revolutions for each test.
2. The test is stopped when 5 breakdowns have occurred in any one revolution.
3. The results are given as the number of breakdowns in each revolution, e. g.:

   a. 0-0-0
   b. 0-0-3
   c. 0-2-5
   d. 0-5

Constant research and experimentation have enabled American Cyanamid to make many other important contributions to plastic development in the electrical field.

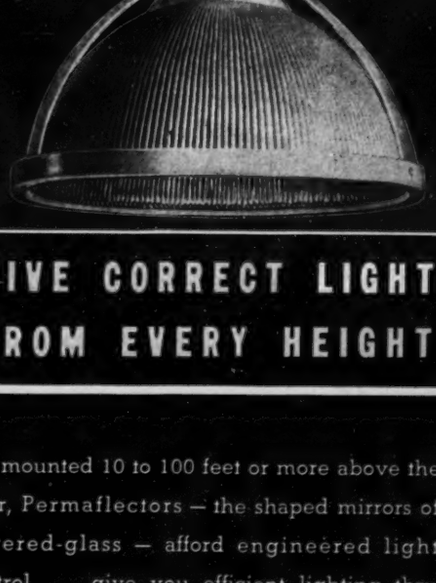
*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION · 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

BEETLE · MELMAC · URAC · MELURAC · LAMINAC

PERMAFLECTORS



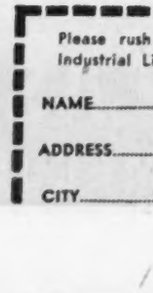
CONCENTRATED

GIVE CORRECT LIGHT FROM EVERY HEIGHT

100' 90' 80' 70' 60' 50' 40' 30' 20' 10'

. . . mounted 10 to 100 feet or more above the floor, Permaflectors — the shaped mirrors of silvered-glass — afford engineered light control . . . give you efficient lighting thru a wide range of light distribution — from the broadest to the most concentrated . . . with mercury vapor lamps, incandescent lamps, or a combination of both . . . mounted as single units or on dual hangers . . .

MEDIUM



BROAD

PITTSBURGH REFLECTOR CO.

OLIVER BLDG. PITTSBURGH, PA.

Please rush complete data on Permaflector Industrial Lighting Units. EW-11-43

NAME_____

ADDRESS_____

CITY_____ STATE_____

applied. Nylon with its high softening point approaches the thermosetting materials in maximum service temperature and overcomes a disadvantage of the thermoplastics, while retaining their advantages.

Other claims for nylon are: light weight (specific gravity is 1.14); extremely slow burning rate; resistance to aging; resistance to oil, grease, solvents, alkalis and weak acids; easy machineability; good electrical properties at various relative humidities (see accompanying table) and the fact that it can be molded with existing equipment with minor modifications.

Some Properties of Molded Nylon

Dielectric constant	
60 cycles, 0 percent R.H.	3.8
10^3 cycles, 18 percent R.H.	4.0
10^6 cycles, 0 percent R.H.	3.6
Power factor, percent	
60 cycles, 0 percent R.H.	1.0
10^3 cycles, 18 percent R.H.	5.0
Dielectric strength, v.p.m., 50 percent R.H.	
Short time	400
Step by step	300
Water absorption, percent by wt., 24 hr.	
A.S.T.M. D570-42	1.5
Volume resistivity, ohm-cm.	
50 percent R.H.	10^{15}
Specific gravity	1.14
Specific volume, cu. in. per lb.	
Molded article	24.3
Molding powder	55.4
Tensile strength, psi.	
— 60 deg. F.	17,000
+ 77 deg. F.	11,000
+140 deg. F.	9,000
Flexural strength, psi	13,000-15,0

Applications

Coil forms of nylon were the first strictly plastic application. Its ability to flow around inserts and its strength and heat resistance make it particularly suitable for such usage.

Nylon in solution, which forms a film when applied, is currently used to insulate electrical wires. Wire is coated by running it through a solution at the rate of a mile a minute. In addition to good electrical properties, resilience and absence of fatigue adapt nylon to this use. It also is used to coat fabrics.

In addition to being a raw material for moldings it will be available in forms of film and extruded tubing after the war. All nylon now is strictly allotted for military and essential civilian requirements.

WAR PRODUCTION KEPT IN HIGH GEAR . . .

. . . by O.S.* in factory turbine

HOW GOOD is the turbine oil you now use, at resisting high temperatures? Air? Water? None of these faze Shell Turbo Oil. For in addition to having *superior oxidation stability,* it also *prevents rust* . . . two of the most vital characteristics a turbine oil must possess in order to give economical, trouble-free performance in today's high-speed turbines.

No wonder Shell Turbo Oil, even after 20,390 hours of continuous operation in the turbine of a leading manufacturer came through with the analyses shown at right. Can the turbine oil you now use match this performance in every respect?

For details on this and other outstanding performances of Shell Turbo Oil see the Shell man. Or, write Shell Oil Company, Inc., Dept. "I", 50 W. 50th St., New York 20, N.Y., or 100 Bush St., San Francisco 6, California.

CERTIFIED PROOF OF THE SUPERIOR

*OXIDATION STABILITY

OF SHELL TURBO OIL

CHARACTERISTICS		
150-170	*Viscosity @ 100° F.*	166
Clear	*Appearance*	Clear
.05	*Neutralization No.*	.05
.1	*Saponification No.*	.2

Performance record of Shell Turbo Oil in a 2000 kw. unit of a famous farm machinery manufacturer.

SHELL

SHELL TURBO OIL

Currently, the U.S. Navy has first call on Shell's entire production of marine turbine oil

Never Before - A Motor

You've never seen a motor like this new Fairbanks-Morse Motor, because never before have so much stamina, versatility, and protection been put inside of one motor housing!

CHECK THESE POINTS:

✓ **1.** *40° C. Motor.*

✓ **2.** *Protected frame.*

✓ **3.** *Conduit box* with features that give new meaning to "adaptable," "convenient," and "handy."

✓ **4.** Famous Fairbanks-Morse *COPPERSPUN* Rotor—the *ONLY* rotor centrifugally cast in *ONE* piece and of *COPPER*.

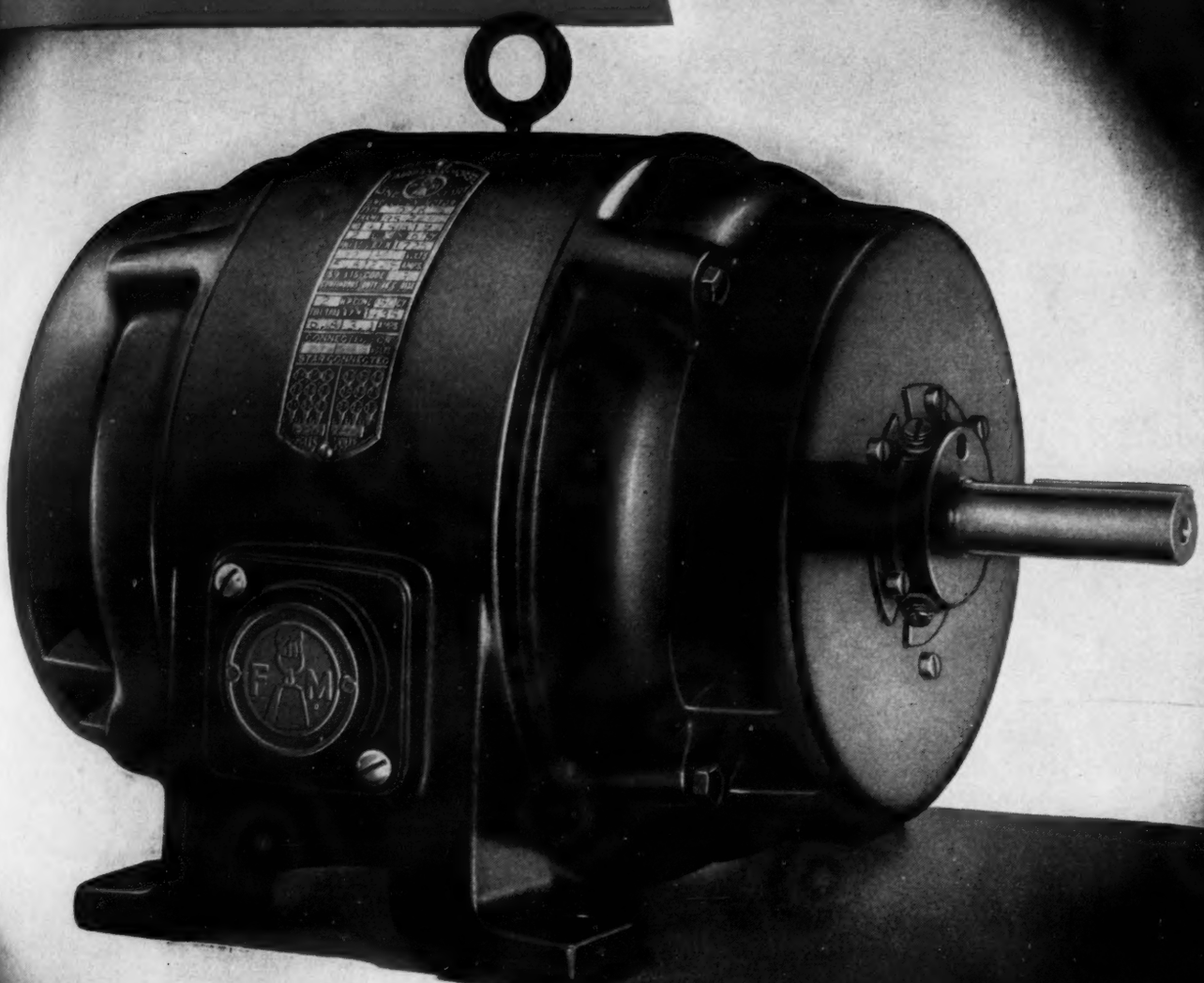
If you are buying motors now but want them to be up-to-date for postwar production, see this motor demonstrated. *There's no other way to appreciate how much more* it offers you! Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago, Ill.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

Motors

Like This



WITH *Copperspun* ROTOR

Buy War Bonds

M-R

FIBREGLAS ELECTRICAL INSULATIONS

TUBINGS
TAPES
CLOTHS
and
FABRICATED
PRODUCTS

Protect ELECTRICAL EQUIPMENT!

MITCHELL-RAND
for
54 YEARS
THE ELECTRICAL
INSULATION
HEADQUARTERS

INSULATION
M-R
COMPANY
EST. 1889

Overloading . . . high or low temperatures . . . moisture . . . corrosive acids, vapors or fumes . . . oils . . . greases . . . dust or dirt, the destructive elements of ordinary electrical insulations WON'T AFFECT M-R FIBREGLAS inorganic ELECTRICAL INSULATION.

The success story of FIBREGLAS ELECTRICAL INSULATION abounds with fewer breakdowns, less maintenance, elimination of waste, savings in labor and materials and proves its value as the optimum in *Electrical Insulation Protection.*

MITCHELL-RAND INSULATION COMPANY, INC
51 MURRAY STREET COrtlandt 7-9264 **NEW YORK 7, N. Y**

Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines
Cable Filling and Pothead Compounds
Friction Tape and Splice
Transformer Compounds

A PARTIAL LIST OF M-R PRODUCTS
Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types

Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

OAD SERVICING

Industrial • Commercial • Rural • Residential

urvey of Post-War ower Possibilities

By J. F. GASKILL
ales Manager, Philadelphia Electric Company

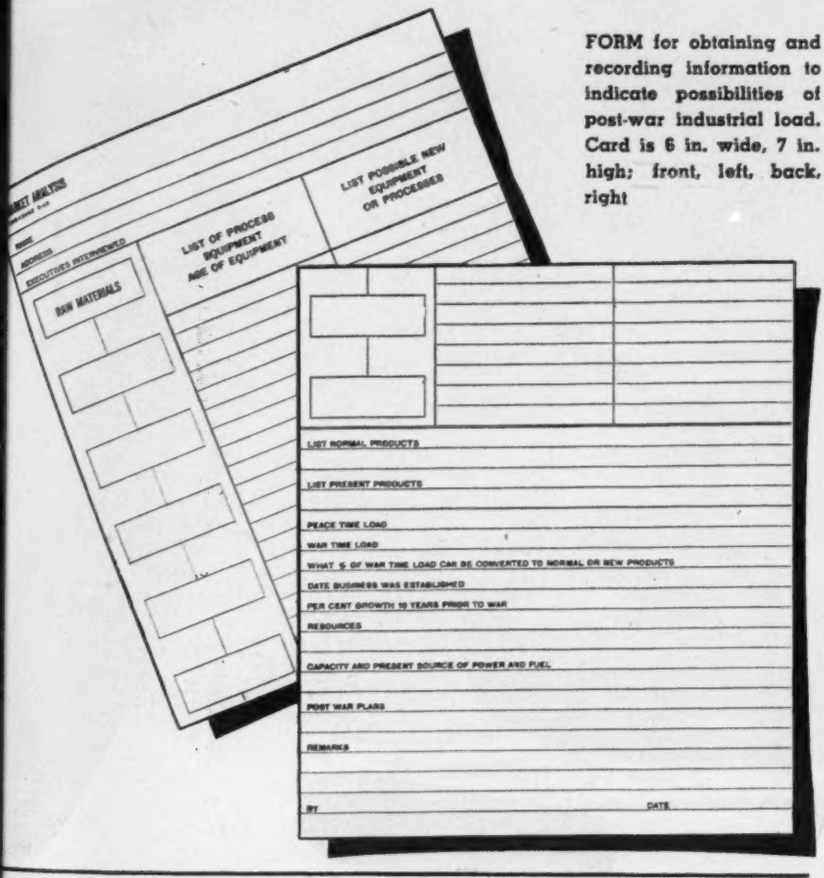
Two purposes have impelled the hiladelphia Electric Company to ndertake a survey of post-war indus- ial load potentialities. They are:

1. To enlarge knowledge of the arket, its needs, its resources and e degrees to which electrical ap- ications are and can be used.

2. To obtain a general idea of the ation between previous peacetime d present wartime loads and to rn the customer's thoughts on post- r plans and on the problems of re- conversion to peacetime production.

As appears from examination of the survey card in the accompanying illustration, questions have been kept to a minimum because of wartime pressure on industrial executives.

The card was designed with a view toward ease of handling, filing with existing customer information and multiple use where necessitated by size and complication of customer's plant. The blocks resembling a flow chart at the left of the card are there to permit a general division of the plant into departments. We feel that such a general division will help the engineer in the actual work of the survey and in the analysis of the information reported. The form of the card is regarded as experimental and it is expected that as the survey proceeds it will be improved.



FORM for obtaining and recording information to indicate possibilities of post-war industrial load. Card is 6 in. wide, 7 in. high; front, left, back, right

Trading Post Plan Rather Disappointing

Reported success of utility programs to make available to the public some of the scarce plug-in electrical appliances through the so-called trading post idea led the Pacific Gas & Electric Company to try out the plan in its Sacramento division with a population of some 150,000. Results were rather disappointing.

Twenty-three appliance dealers participated in the campaign, included among which were all large department stores, furniture stores and a good geographic distribution of dealers of all kinds. The plan was well organized and publicized by 45,000 mailing pieces with customers' bills, newspaper, radio and dealer advertising as well as window displays.

Despite all this, only 201 appliances were accepted and paid for in war stamps. Average buying price was approximately $1.50 per appliance. Irons averaged $1.25, toasters $1 and grills, fans, hot plates, waffle irons, etc., $1.50. Of the 201 appliances, 124 were usable and 77 needed repairs. Only 79 were sold during the six weeks' campaign.

Various Reasons

The small number of appliances turned in could be the result of any one or all of the following:

1. That most of the not-in-use appliances were turned in during the scrap metals drive. On checking with local authorities it was found that a large volume of used appliances was turned in during the scrap drive and that these were segregated and sold to used appliance dealers.

2. That many of the usable appliances have already been sold or put into use by private sale or donations.

3. That the $1 minimum was overemphasized and that many people believed it to be the offering price. This complaint was heard several times, but shows careless reading rather than poor campaign planning as the terms of the offer were perfectly clear. Many felt that $1 was too little for certain appliances.

4. That the appeal was not strong

In Which We Serve

This is the story, briefly told, of men and women who turned from the arts of peace to the grim trade of war. And in their story of individual achievement you may read the story of America.

In December, 1941, the men and women of Kelvinator were building the revolutionary Moist-Master Kelvinator Refrigerator, which provided ideal humidity for keeping uncovered foods fresher days longer. Based on Kelvinator's remarkable sales advances in 1940 and through 1941, Kelvinator retailers —backed by the industry's soundest franchise—were looking forward to the greatest sales gains in refrigerator history.

And then, virtually overnight, the men and women of Nash-Kelvinator, so well versed in production for peace, turned to production for war.

Now in this December, two years after Pearl Harbor—what account can we and they render of our war service?

This . . .

Having designed and built the incredibly precise Polarsphere Sealed Unit, we are now building intricate Hamilton Standard propellers for Flying Fortress, Liberator, Mosquito, Mitchell, Lancaster, Baltimore, Dauntless, Havoc, Skytrain and Skytrooper planes. And we have become the largest manufacturer of this type of aircraft propeller in America.

SCRAP IS POWER

Cooperate with your industry! Salvage all inoperative parts containing critical material . . . put vitally-needed scrap back into the scrap TODAY!

Freedom...

We are building the great 2,000 h.p. Pratt & Whitney supercharged, eighteen-cylinder engines that power the Vought Corsair fighters of the U. S. Navy. And these are the planes that are helping to break the back of Japanese air power.

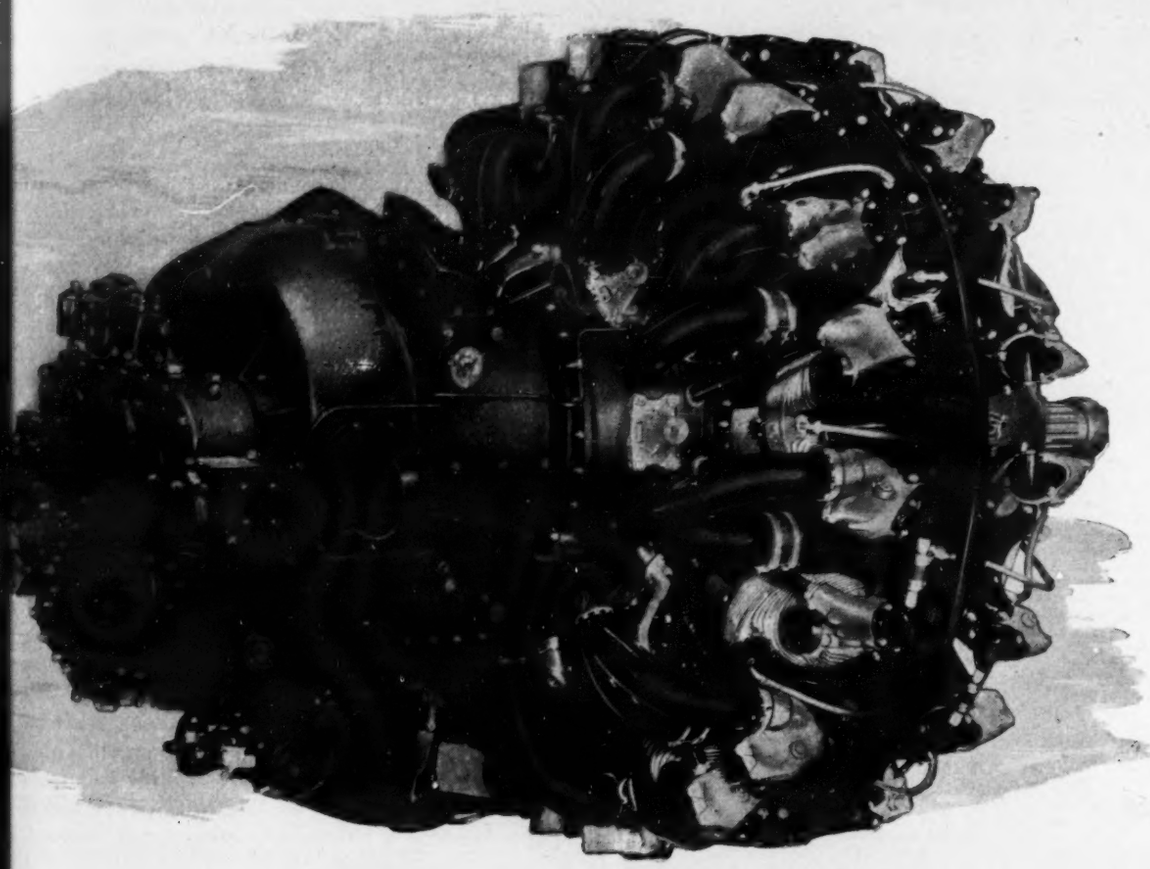
We are now readying our production lines to build Sikorsky helicopters for the Army Air Forces. And this newest aerial marvel, which can rise vertically, hover motionlessly, fly forward or backward, will be built only by Nash-Kelvinator and its designers, the Sikorsky Division of United Aircraft Corporation.

Having a reputation for precision manufacturing, we are building governors for the propeller mechanisms of Flying Fortress, Douglas, Consolidated North American and Martin bombers—and Navy PBY1 and PB4Y1 patrol bombers. And, we are now one of the largest manufacturers of binoculars in the world.

In this brief period of less than two years, Nash-Kelvinator facilities have been expanded tremendously and our production for war is now virtually double our former production for peace.

This is how we have served America . . . have served you . . . are serving freedom. This is the story of how free men and women, with the will to stay free, the desire to keep America always a land of progress and individual opportunity, are working day and night to hasten Victory so that they may turn once again to the building of an even finer Kelvinator.

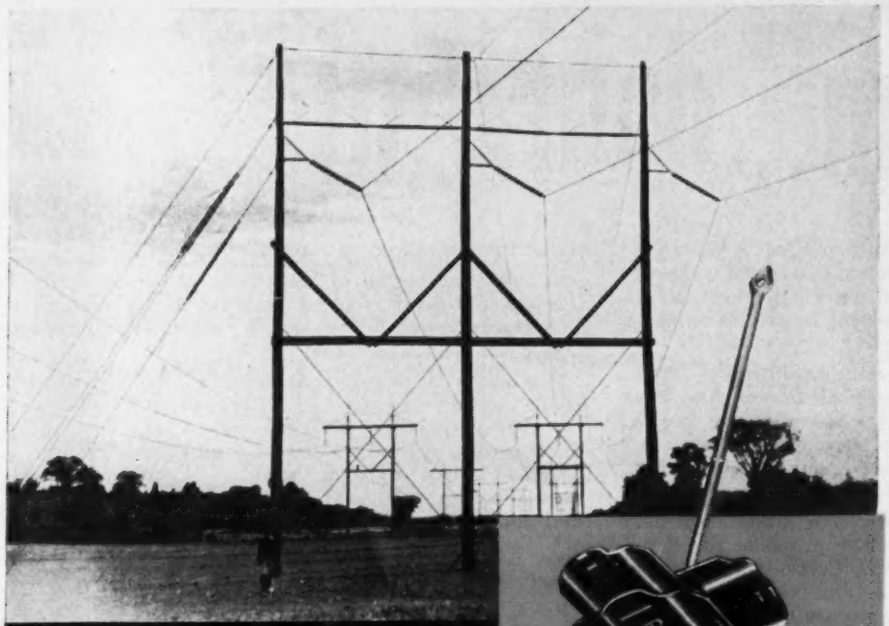
The men and women of the Propeller Division of Nash-Kelvinator Corporation have been awarded, and proudly fly and wear, the famous Army-Navy "E" for High Achievement in War Production.



LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing



Where pole lines take the place of towers . . .
CHANCE ANCHORS will carry the load

Pole Lines that go up to save steel for war are proving to be adequate for carrying the heavy loads and a good deal of the credit must go to the big Never-Creeps, the Chance Steel Expanding, and other Chance Anchors that keep the lines well guyed.

The variety of anchors shown here meet the most complicated requirements. One of the Never-Creeps, for instance, is made in a 10 x 45 inch size and is rated to hold over 50,000 pounds in hard pan. A big 12-inch four-way steel expanding anchor is rated at 42,000 pounds in the same soil and can be installed in a variety of positions.

Chance Screw Anchors are shown here in three types and are made in several sizes for different conditions.

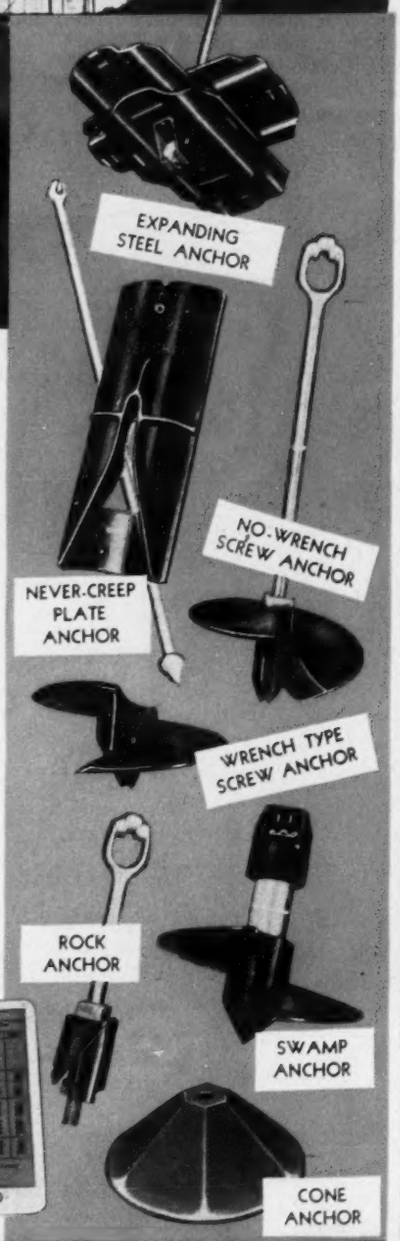
The Swamp Screw Anchor does the job in swamp land and may be installed under water in flooded areas.

Where rocks abound, the Chance Rock Anchor holds without the aid of lead or concrete and saves a lot of installation time.

Chance Cone Anchors range into big sizes too. There's a 23-inch regular, rated to hold 32,000 pounds. Another special cone measures 32 inches in diameter.

Standardization, of course, is best wherever it is possible to use one type and size anchor throughout, but the best results cannot always be obtained in that manner. That is why Chance Anchors are made in so many different types and sizes. It pays to analyze each job and select anchors accordingly.

This free guy calculator will help you in making anchor selections. Your Chance catalog will give you the details for ordering. Send for either one or both without obligation.



A·B·CHANCE CO.
CENTRALIA, MISSOURI.

enough to overcome human inertia and that many persons having old appliances just did not respond.

At any rate, considering the active promotion and co-operation the campaign received, the results were disappointing and indicate that the expenditures necessary for this type of campaign are not justifiable. Only 8.75 appliances per dealer were turned in at a promotional cost of approximately $5 per appliance.

•

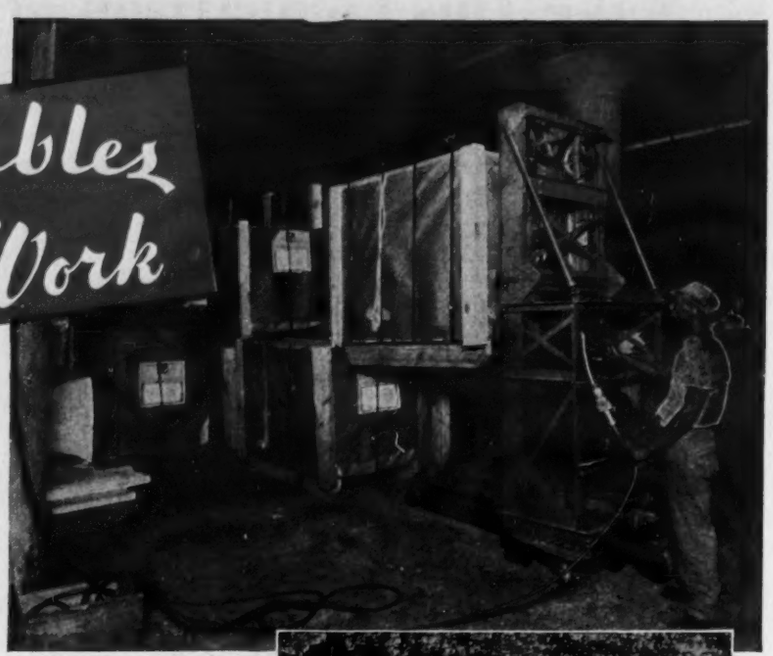
Electric Service at Boston Concert Shell

Utility company co-operation aided the builders of the Edward Hatch Memorial Music Shell at Boston to provide maximum convenience of service in connection with the Esplanade concerts of the Boston Symphony Orchestra on the shores of the Charles River Basin. The shell interior is 80 ft. wide x 34 ft. deep x 43 ft. high, and accommodations for the orchestra personnel include various auxiliary rooms, corridor and other facilities. The illuminating engineering and power sales departments of Boston Edison assisted in the lighting and power layout, which called for 100 kw. in connected lighting load.

The interior dome is of teakwood set in a herringbone design, covered with a special du Pont stain containing phosphorus to present a sparkling effect under illumination. The dome was built in tiers, the lighting facilities being concealed from the audience. Footlights are divided into seven sections on each side and total 21 kw. Various flood and down lights aggregate another 25 kw., and a terrace in front of the shell has 1,200 watts of illuminating equipment. Basement rotunda and other rooms make up the balance of the lighting requirements, most of the equipment calling for either lens reflectors or recessed lens units.

All-electric heating has been installed. There are two 30-kw. blast heaters delivering warm air under pressure for the several rooms. Fifteen wall heaters of 1 to 3 kw. each provide supplementary heat, all heaters being thermostatically controlled. Hot water for showers is provided by two 40-gal. Hotpoint tanks. Among the auxiliary electrical features are electric stairways, a fan on the podium

Trailing Cables FOR Vital WAR Work



TIREX - rubber sheathed - cables were designed for hard, rough work. They still have remarkable wearing qualities and abrasion resistance and can be depended upon for continuous, dependable performance but, for the duration of the war, they meet restrictions governing the use of rubber, copper and other scarce materials.

It is important, now more than ever before, to get maximum service from trailing cables upon which portable or mobile electrical equipment depends for current. New cables are hard to get and those already in service must be used until they are completely worn out. To this end we make four suggestions.

1. As far as possible use the proper size and type of cable for the work to be done.
2. Provide extra protection or change location where exposure is hazardous.
3. Inspect cables frequently and regularly to discover conditions that may cause trouble.
4. Make repairs promptly when needed.

If you must have new cables for vital war work we shall be pleased to do anything we can, consistent with conservation restrictions, to help you get what you need.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY E NAVY

Simplex

WIRES and CABLES

Make This Comparison of

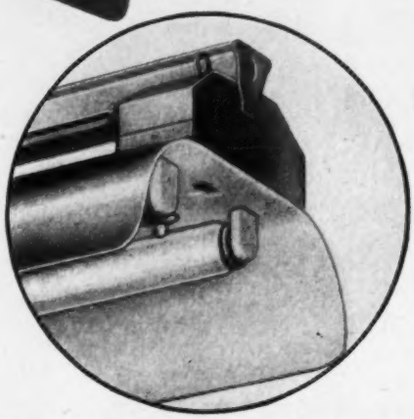
"Skilled Lighting"!

Compare the Wheeler 1943 RLM Fluorescent Fixture with any other fixture made in accordance with latest WPB requirements. Its trim, compact appearance truly indicates its simple, sound engineering, **outside and in!**

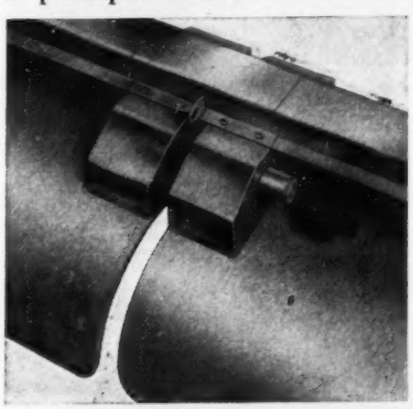
Wiring channels, for example, are hollow steel I-beams combining light weight and extreme rigidity. Provide durable support, easy adjustable suspension, instant access to starter switches.

Reflectors, too, are typical Wheeler "Skilled Lighting" . . . designed with the "know how" of 62 years' experience. Made from tough, nonflammable, moisture-resistant material . . . chip-proof, washable enamel, inside and out. Rugged, lightweight, durable. And higher in lighting efficiency than many porcelain-enameled metal reflectors!

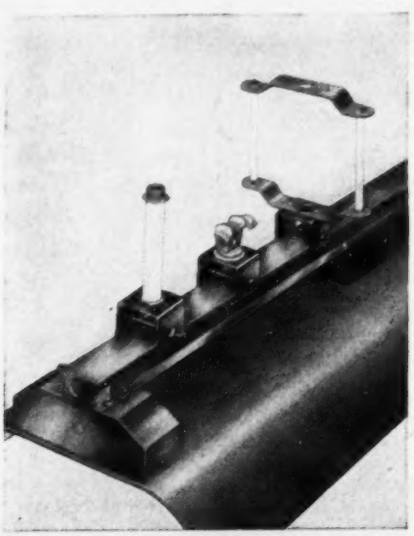
Write for detailed Bulletin 72. **Wheeler Reflector Company, 275 Congress Street, Boston 10, Mass.** . . . New York City. Representatives in principal cities.



Rigid weight-conserving steel wiring channels. Easily accessible operating parts. Reflection factor not less than 85% gives better than 80% overall efficiency in 48" two-lamp units, 76% in three-lamp units, 74% in 60" two-lamp units.



Continuous Installations easily made with speedily-applied couplings. Note accessibility of starter switches.



"C-Clamp" Hangers afford conduit, messenger cable, rod or close-to-ceiling suspension. Loops for chain hanging.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

for the conductor's comfort, a publ address system and annunciat panels.

•

H. F. Heating Service Values

Stimulated by war demands, hig frequency heating equipment on o utility system has attained a total co nected load of about 11,000 kw. T applications include heat treatme melting, brazing and soldering, wi frequencies ranging from 960 to 50 000 cycles. "High spots" of five re resentative cases are given below:

Case I—Melting Stainless Steel

Equipment—Two Ajax high-fr quency furnaces, each with a capaci of 1,100 lb. Each furnace is energize by a 333-kw., single-phase, 960-cyc 800 to 1,100-volt generator driven b a 500-hp., 6,900-volt, three-phase, 6 cycle motor.

Operating Data—Melting time a proximately one hour. One furna operated at a time. Energy consum tion, approximately 700 kw.-hr. p ton.

Advantages—Ability to reprodu prescribed analysis in each melt. Ca bon-free melting—no contaminat from electrodes as is possible in el tric-arc furnace. Excellent mixing metal due to "stirring" effect. Ex control of power input. Fast melti at high efficiency. Good load fact Skilled operators not required.

Case II—Hardening Steel Strip

Equipment—Eighteen Ajax hig frequency furnaces, supplied fr three 150-hp. motor-generator sets d livering 4,800-cycle current. Heati element consists of Nichrome ta heated by high-frequency field. Co trolled atmosphere in tube preve oxidation.

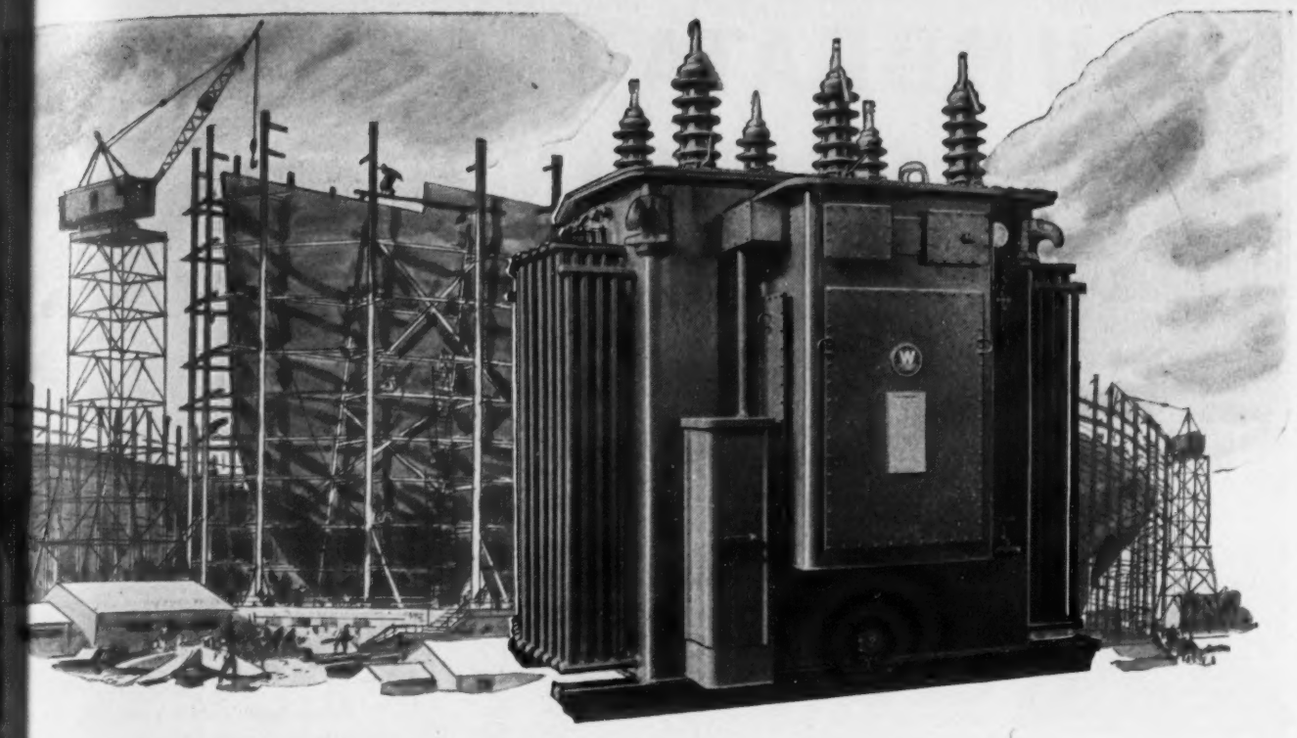
Operating Data—The strip is r continuously through the tubes a is raised to a temperature of 15 deg. F.

Case III—Heat Treating 75-mm. Am Piercing Projectiles

Equipment—Three Ohio Cra shaft Company high-frequency he ing machines.

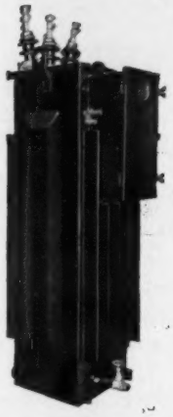
Unit No. 1. Special machine f heat-treating supplied from a 20-k 220-volt, 9,600-cycle generator, driv by a 40-hp. motor.

Unit No. 2. Special machine f

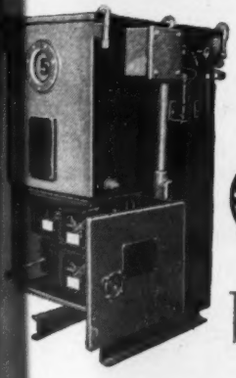


THE POWER PACKAGE THAT'S

Helping to launch a thousand ships



Westinghouse builds a complete line of feeder voltage regulators for all types and sizes. Liquid-immersed step and induction regulators for indoor and outdoor service and natural air-cooled regulator for indoor service.



Launchings of cargo vessels are ten times what they were less than two years ago. That means almost as great an increase in shipyard electric current requirements during the same period.

Such sudden rises in power needs are difficult enough to meet in peacetime—but wartime restrictions on critical materials for the construction of new power lines accentuate the problem.

Fortunately the answer already has been proved in actual use: Westinghouse step-type voltage regulation. This method often provides the needed additional capacity with *no* increase in generating facilities and without installing any additional power lines. Moreover, the improved voltage conditions spell better lighting, better motor performance, and earlier attainment of full productive capacity.

There is a Westinghouse Feeder Voltage Regulator to fit your needs, whether indoor or outdoor, large or small. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania. J-70414

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Voltage Regulators

WHY YOU NEED VOLTAGE REGULATION:

1—*Low Voltage Affects Motor Torque*—Motor starting torque drops off at a greater rate than actual voltage drop.

2—*Low Voltage Ups Motor Current Consumption*—Motors required to deliver rated output use more current if voltage falls off.

3—*Low Voltage Impairs Lighting*—Continuously good illumination depends primarily on proper voltage conditions.

4—*Low Voltage Interferes with P. F. Correction*—Any voltage drop sharply reduces the effectiveness of capacitors in correction of power factor.

AN UNBEATABLE COMBINATION

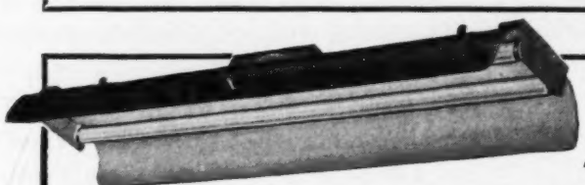
SILV-A-KING lighting equipment *plus* Silv-A-King lighting service makes an unbeatable combination! Nearly a quarter-century of specialized experience in the field of industrial lighting—both incandescent and fluorescent—is behind the Silv-A-King equipment you buy...and Silv-A-King lighting service includes expert guidance in planning the layout of your lighting installation to insure maximum efficiency. All Silv-A-King lighting units are made in conformity with RLM and other standards for the highest quality and efficiency. Silv-A-King lighting engineers are available to discuss your lighting problems.

SILV-A-KING RLM STANDARD DOME REFLECTORS

One-piece, drawn or spun, seamless steel reflector completely vitreous porcelain enameled, white inside, green outside. Highly efficient. Permissible spacing for these units, one-and-one-half times the mounting height. Made in sizes 12" to 20", 75 to 1,500 watts.

SILV-A-KING RLM DEEP BOWL REFLECTORS

Porcelain enameled finish on reflecting surface assures high-efficiency lighting and easy maintenance. Recommended for installation where spacing of units does not exceed mounting height. Made in sizes 8" to 16", 60 to 1,500 watts.



SILV-A-KING "VICTORY" UNITS

Efficient fluorescent lighting units with metal-saving reflectors of non-critical Silv-A-Tex. Units conform to all RLM Standards. High-gloss baked enamel reflecting surface comparable in efficiency to porcelain enamel. Silv-A-King "Victory" Units provide even, glare-free light for recommended "daylight" illumination or for supplementary lighting of individual machines or work areas.

SILV-A-KING RLM SYMMETRICAL ANGLE REFLECTORS

High efficiency, porcelain enameled reflecting surface. Units designed for angular distribution of light for illumination of vertical surfaces, such as walls, signs, etc. Made in sizes 8" to 16", 100 to 1,500 watts.

OTHER SILV-A-KING PRODUCTS

Dust-Tight Units
High Bay Mounting Units
"HIM" High Intensity Mercury Units
Island Lights
PAR-38 Projector Lamp Wiring Troughs
"RF" Rectified Fluorescent Luminaires
RLM Silvered Bowl Diffusers
Stock-Aisle Reflectors
Vapor-Proof Lighting Units

FLUORESCENT
SILV-A-KING
INCANDESCENT

BRIGHT LIGHT REFLECTOR CO., INC · *1035 Metropolitan Ave., Brooklyn 2, N.Y.*

heat-treating supplied from a 60-kw. 440-volt, 9,600-cycle generator, driven by a 110-hp. motor.

Unit No. 3. Same as unit No. 2.

Operating Data—Unit No. 1—Machine heats four shells at a time for six minutes, soaks them for two minutes and cools them under water spray for two minutes. This operation soft-ens the projectile skirt for subsequent machining.

Unit No. 2—Machine performs the same operation as unit No. 1, but processes twelve projectiles simultaneously.

Unit No. 3—Machine handles four projectiles at a time, heating the caps for 35 seconds and quenching them under a water spray. This process hardens the caps. The sequence and timing of each operation is automatically controlled. The operator simply loads and unloads the projectiles.

Advantages—Heat-treating time greatly reduced. Minimum distortion. Restricts heat treatment to selected areas and sections. Accurate control of temperatures and timing. Reduction in heat treating costs. Does not require particularly skilled operators.

Case IV—Silver Soldering 20-mm. Steel Projectile to Brass Case for Reclaiming Shells for Gun Loading Practice

Equipment—Lepell high-frequency equipment—30 kva., delivering high-frequency current from spark gaps at 200,000 cycles.

Operating Data—The shell with projectile in place is fitted with a ring of silver wire and flux at the seam. The assembly is placed in a coil carrying the high-frequency current and the area to be soldered is heated to approximately 1,300 deg. F. in 15 seconds. Six shells are soldered at once, while six more are being loaded into place for brazing.

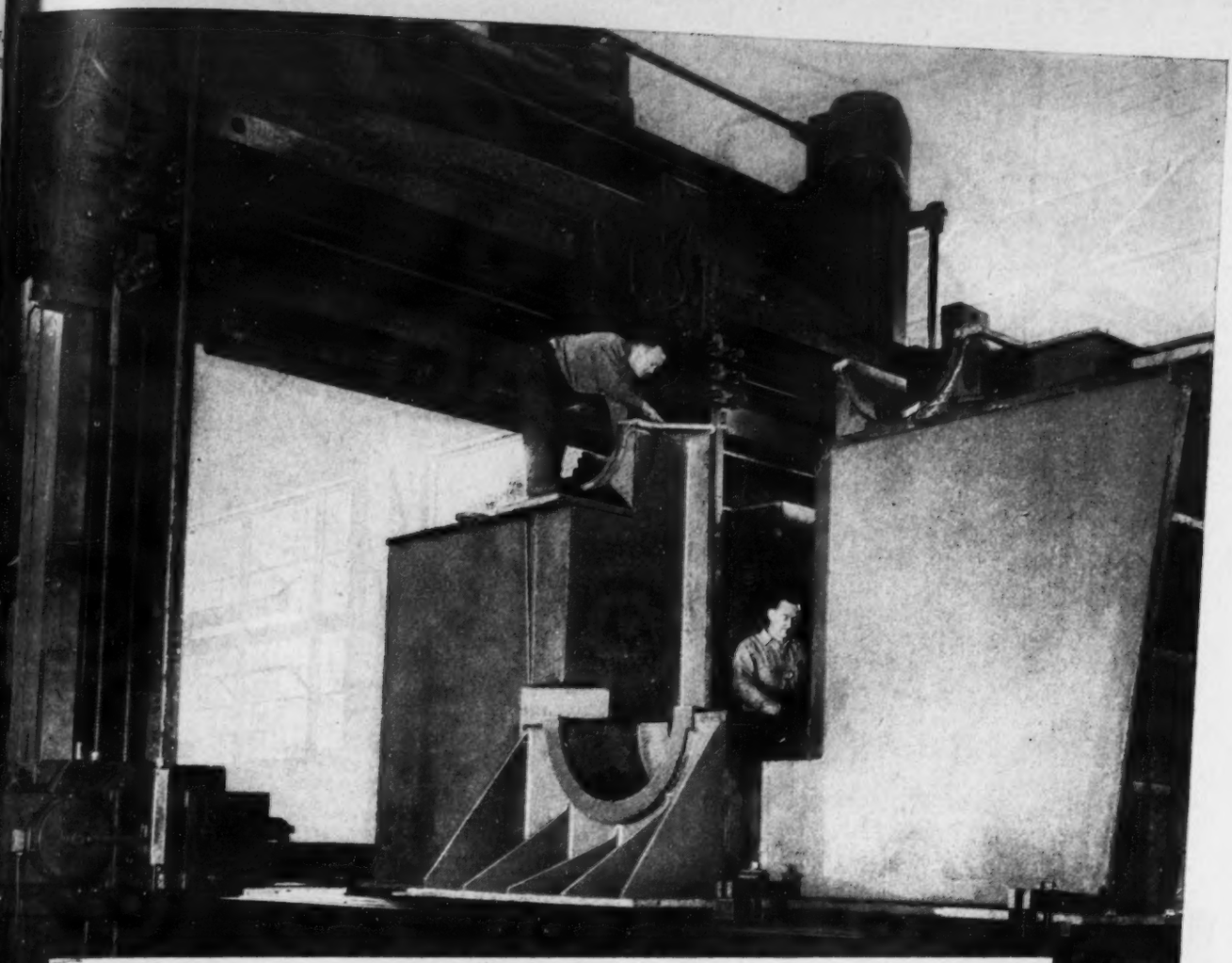
Advantages—Uniformity of product. Automatic control of timing. Conservation of brazing material.

Case V—Heating Bushings for Shrinking to Other Part

Equipment—Low-voltage, high-current secondary, 60-cycle, 25-kva. transformer with ring coil element.

Operating Data—These bushings are 3¾ in. O.D. and 3⅜ in. long, with a wall thickness of ¼ in., and are heated by induction to 450 deg. F. in 75 seconds.

Advantages—Speed of operation. Dependability of results. No particularly skilled operators required.

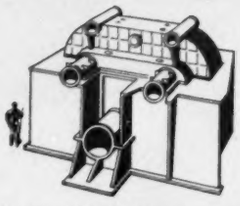


"Barber Chair" FOR A 21-TON GEAR CASE

Here's probably the biggest "barber chair" you've ever seen! And its current customer is a 21-ton gear reduction case for the new 8,500 h.p. Hendy steam turbine units being "shaved" in meticulous thousandths of an inch.

This "chair" is known as a planer and its load capacity of 75 tons on a 510 sq. ft. bed shows the tremendous size of the jobs that Hendy is equipped to handle.

However, this planer is only one unit in the vast array of major equipment that is helping Hendy and its divisions set unprecedented records for turning out massive power equipment with straight-line production methods.



For the Maritime Commission and the Navy Department Hendy production includes steam turbines and reduction gear units up to 8,500 h.p., Liberty and Frigate steam engines, turbo-lighting sets, naval ordnance, hydraulic pumps, motors and generators.

JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

SUNNYVALE • CALIFORNIA

Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO.

Manufacturing Plants: SUNNYVALE, LONG BEACH, POMONA and TORRANCE in CALIFORNIA • AMPERE, N. J. • ST. LOUIS, MO.
Branch Offices: NEW YORK • WASHINGTON • PHILADELPHIA PITTSBURGH • CHICAGO • ST. LOUIS • SAN FRANCISCO • LOS ANGELES

...then perhaps he said to himself

A TEN-MONTH DELIVERY

MR. ROOSEVELT'S LETTER
President Roosevelt's letter to Mr. Churchill read as follows:
Dear Mr. Prime Minister:
When you were with us during the latter part of December, 1941, and the first few days of 1942, after we had become active participants in the war, plans for a division of responsibility between your country and mine became
Here there had been developed a welding technique which enables us to construct standard merchant ships with a speed unequaled in the history of merchant shipping.
well as in other matters, we agreed that mutual advantages were to be gained by concentrating, in so far as it was practical, our energies in doing those things which each of us was best qualified to do.
Here in this country in abundance were the natural resources critical materials.
Here we had waiting cargoes be moved in ships to your d and to other theatres. If country was to have carout its contemplated ship ruction program it would been necessary to move onnages of raw materials e have here across the
Atlantic to your
and then, in
ships, to send
ports for the
waiting to be
Materials
Obviously,
tailed a waste
time.
It was only
to decide
the

BIG PIECE OF NEWS the Prime Minister read to the House of Commons—the 10-months' delivery of a couple hundred ships.

Again the old formula: BIG name in the NEWS . . . made big by Big Production . . production made big by RECOURSE TO ARC WELDING (remembering Webster's short de nition of RECOURSE as "a going to for a or protection").

So the President has written the formula into t history of the world: "Here there had been dev oped a welding technique . . . with speed unequale

THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

"A Welding Technique" *he said*

★ ★ ★ ★ *"with speed unequalled in the history of merchant shipping"*

...and this, Mr. Prime Minister, is what he meant:

Ships a Month

hat the general un-
we reached, during
ys of our engagement
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ish services on a voyage-to-
age basis large numbers of
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at I am directing the War
ipping Administration to car-
out, will be in the nature of a
ubstitution to the extent of
onnage transferred for the
merican tonnage that has
sually been employed in your
war program.

Details of the arrangements
we can properly leave to national
shipping authorities for settle-
ment through the Combined
Shipping Adjustment Board,
whose function it is to concert
employment of all merchant ves-
sels, and will in accordance with
its usual practice do so in con-
nection with these particular
ships.

Always sincerely,

FRANKLIN D. ROOSEVELT.

SHOP FABRICATION. Ships welded on a production line by assembly line methods—faster welding by positioning the welding—pre-fabrication of large sections—upside-down assembly—dozens of short-cuts make up this technique, recourse to which has revolutionized shipbuilding.

MASS PRODUCTION. If ships can be put on a mass production basis, think of the speed and economy in producing products less bulky. If speed alone were the only benefit of welding, *recourse* to it might be debatable. But consider these additional benefits:

LESS STEEL
On these 200 ships, *recourse* to arc welding saves 375,600 tons. Steel is critical. Steel costs money.

LESS HULL FRICTION
A welded Liberty ship leaving New York would reach Sicily 40 hours quicker than its rough-skinned sister of equal horsepower.

INCREASED CARGO
18% more cargo carrying capacity is provided by weight-cutting through *recourse* to arc welding.

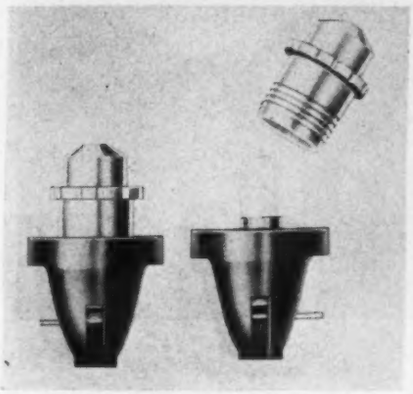
America's greatest natural **recourse**

ARC WELDING

NEW EQUIPMENT

Indicator Lamp

Applicable where a glow lamp is needed to show that the device or circuit is on or off, a small indicator lamp features a lock-



Molded plastic indicator lamp; 6 to 8-volt bulbs; color caps—amber, red, green, white and blue. Electronics Department, **General Electric Co.**, Schenectady, N. Y.

on color cap which, it is said, cannot be shaken loose and will not "freeze" to the base. The base is mounted to the back of the instrument panel and the color cap is screwed into the base through the panel. A coil spring applies pressure to the base of the lamp bulb to maintain a good electrical contact.

•

Crane Drive Unit

"Travelator;" capacity up to 10-ton cranes. **Northern Engineering Works**, Atwater and Chene Sts., Detroit, Mich.

Designed to provide motor travel for most hand-traveled cranes, the unit includes a motor with gear reducer, reversing contactor control and push buttons. It is suspended at the side of the bridge, arranged for chain and sprocket drive to the squaring shaft, and can be attached, it is said, in a few hours.

•

Control

"Incher" slow-motion motor control. **Electric Machinery Mfg. Co.**, Minneapolis 13, Minn.

Slow-motion, high-torque rotation of three-phase synchronous motors or slip-ring induction motors is provided by using commutated direct current to supply a slowly revolving three-phase inching current to the motor. Rotating field or rotor are energized by direct current. When inching direct current from revolving commutator equipment is supplied to the motor stator, a series of north and south poles are set up in the stator. Since the rotor is also definitely polarized by its excitation, it will at once turn to line up its poles with those of the stator. Speed and direction of motor rotation can be altered by changing speed or direction of commutator equipment. A motor inching speed of 1 to 2 percent of motor normal speed can be obtained.

•

Instruction Equipment

Electrical rotating machine instruction equipment, set of 19 parts; dimensions of assembled machine, 18 in. long, 12½ in. high, 11 in. wide. **Universal Scientific Co., Inc.**, Vincennes, Ind.

Designed as a training aid in electric machinery courses, one basic set of parts provides visual education in the construction, theory and operation of various rotating machines such as a.c. and d.c. generators and motors, magnetos, variable transformer, induction feeder regulator, self-synchronous motor, position indicator and dynamotor. A set of parts includes such items as a laminated frame ring, six armature coils, removable commutator and slip rings, slot wedges, twelve-slot stator core and bolts, nuts and carbon brushes.

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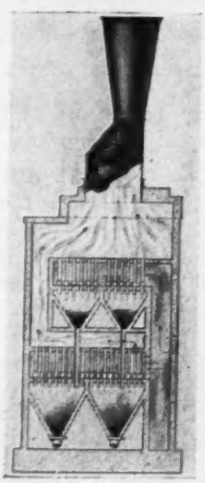
Dust Collectors



Ceramic tubular dust collectors. **Prat-Daniel Corp.**, Port Chester, N. Y.

To save vital steel, dust collectors for fly ash are now being made, according to the manufacturer, of hard and abrasive - resisting fire clay. It is stated that these ceramic tubes are sufficiently thick and rugged to be proof against fracture and breakage from normal handling or from changes in temperature, yet weigh no more than previously used steel tubes. Tubes are mounted in a concrete or brick casing above concrete bins, entirely eliminating use of steel.

BUYING ELECTRICAL EQUIPMENT?— ***McGraw-Hill's Electrical Buyers Reference*** **is a convenient place to look first for manufacturers' product data, names and addresses.**

Resistance Box

Decade box is stated to have resist non-inductively wound with wire having temperature coefficient of +0.00002 tween 20 and 100 deg. C.; minimum re

"Model 5" decade box; resistance rang from 1 to 99,999 ohms in steps of 1 ohm accuracy, one-tenth of 1 percent. **Superio Instruments Co.**, 227 Fulton St., New York 7, N. Y.

tance of the box is 0.018 ohm. Lo resistance switches are used throughou Binding posts accommodate up to No. wire and are mounted on engraved Ba lite panel.

•

Welder

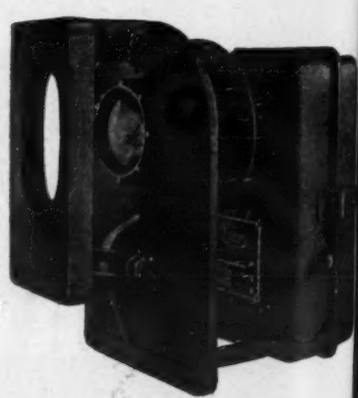
Universal resistance welder; transformer siz 100, 150 and 200 kva., 220 or 440 volts, 6 cycles. **Eisler Engineering Co.**, 740 South 13t St., Newark 3, N. J.

Air-operated, water-cooled, automa press type welding machine is adapta for circular and longitudinal seam we ing. Upper 10-in. ream wheel is driven a 1-hp., 1,425-r.p.m. motor and a variab speed drive between the limits of 0.75 a 2.25 r.p.m., corresponding to a surfa speed of 2 to 6 ft. Dial control is furnish for heat settings. Electronic contactor a welding timer provide automatic cont Conversion to spot welding is accomplish by removing caps from the upper a lower turret and replacing the seam wh shafts with spot welding horns.

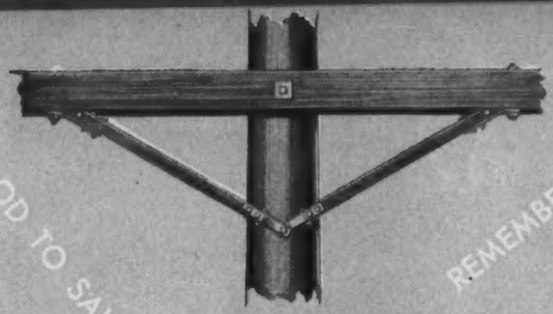
•

Photoelectric Control

A photoelectric system for providing stantaneous fuel cut-off in a pressure- burner in the event of flame failure h been designed to operate entirely fr direct observation of the flame itself. E traneous light is said to be rejected. Li from the flame strikes a sensitive plate o photocell. The regenerated current is a plified to operate a relay which direc controls a solenoid valve governing h feed.



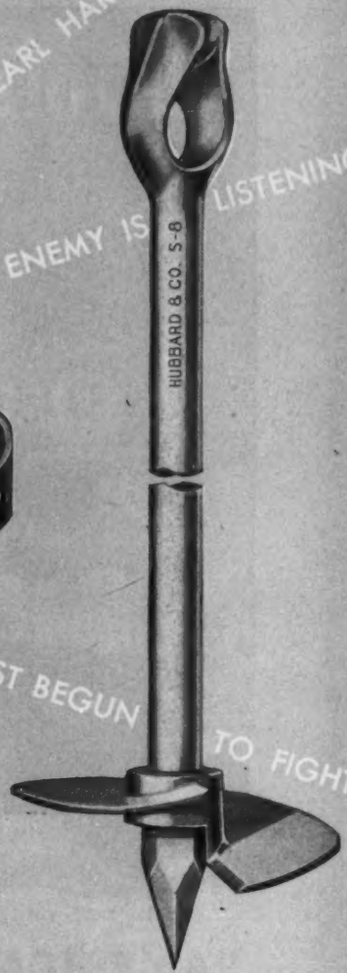
"Fireye F28C" flame failure safeguard. C **bustion Control Corporation**, Cambridge Mass.



No. 5547
Wood Brace

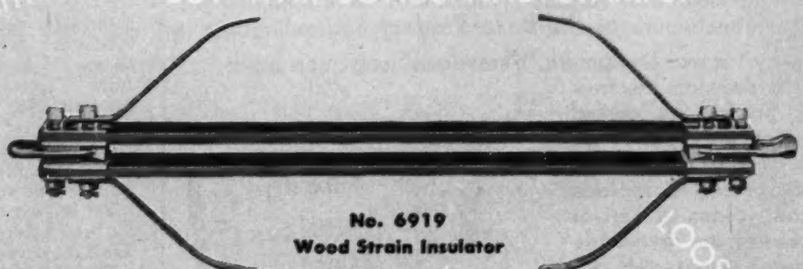
No. 1358
Secondary Rack

No. 7753
Stubbing Band



No. 7528
Steelwing Anchor

Hang the load on HUBBARD HARDWARE!



No. 6919
Wood Strain Insulator

No. 1330
Insulated Clevis

No. 4-11-44
Wireholder

HUBBARD

HUBBARD AND COMPANY

PITTSBURGH OAKLAND CALIFORNIA CHICAGO

BACK THE ATTACK WITH WAR BONDS!

"AMERICAN" *Bomb Platform* BODIES

Are Helping Uncle Sam's Boys Load and Transport the Bombs from Magazines to Planes

● The illustration above shows the simple, time and labor saving, efficient method adopted by the U. S. Ordnance Department for the loading and transportation of bombs from magazines to planes. "American" is proud of the part it has been able to take in the solution of this important problem by the manufacture of the Bomb Platform Bodies Used.

Because of the urgency for war equipment "American" engineers have had but little time to develop the new models envisioned. So for the period immediately following the peace in order to take care of the pressing demands, for new equipment to replace obsolete, "American" plans to deliver as fast as truck chassis are available equipment of the same time-tested design as that built before the war, plus many new construction features that make for longer service and less maintenance.

Many Utilities are today setting their sights for post war operations. When it comes to planning construction equipment "American" engineers are ready to aid you with specifications and designs, of course entirely without obligation.

Some Reasons Why "Americans" Are TOPS:—

Correct Design • Superior Quality Construction • Comfort • Convenience • Safety • Endurance • Low Operating Cost • Fine Appearance

THE American COACH & BODY CO.

PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

TECHNICAL LITERATUR

ANALYSIS OF METALS—A.S.T.M. Comm tees E-3 (Chemical Analysis of Metals) a E-2 (Spectrographic Analysis) have co pleted activities leading to the publicati of the "1943 Volume on A.S.T.M. Che ical Analysis of Metals." The 332-page v ume gives two sampling methods, 17 sta ards and tentative methods of which f are for the analysis of ferrous metals, t for non-ferrous, and three cover quanti tive spectrochemical procedures for no ferrous metals. Copies are available fr the headquarters of the society, 260 Sou Broad St., Philadelphia 2, Pa., in lib cloth binding at $3 per copy.

"CABLE OPERATION—1942" is a joint r port combining the essential features the cable operation studies carried on sep rately by the Association of Edison Illu inating Companies and Edison Elect Institute committees. Copy of Publicati K-6 may be obtained from the Edison El tric Institute, 420 Lexington Ave., N York 17, N. Y.; price $1.25 to non-membe in U. S. A.

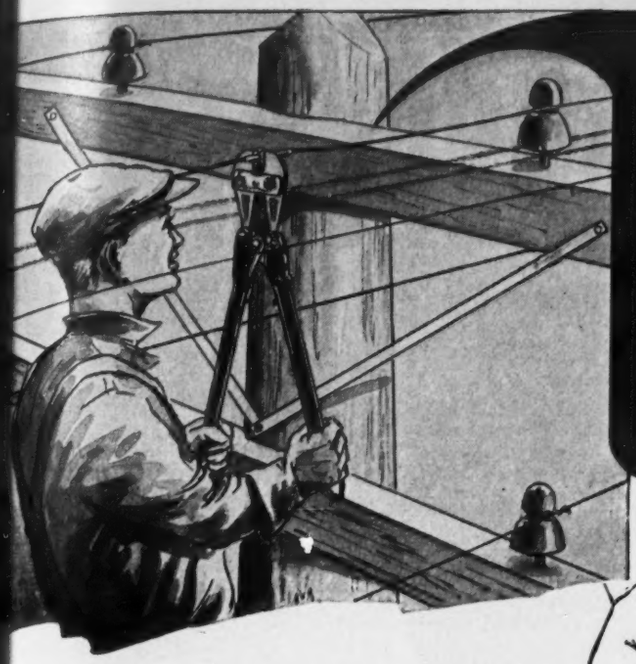
STOKERS—Operating and maintenan hints for efficient operation and minimu outage are listed in two check charts f single-retort and multiple-retort stoke The 16 x 21-in. heavy cardboard cha may be secured from Department 7-N Westinghouse Electric & Manufactur Co., East Pittsburgh, Pa.

FILTERS—Formulas, diagrams and tab listing inductance for low- and high-p series- and shunt-derived filters of ohms and 10,000 ohms characteristic i pedance, frequency, data for band-p filters, and L and C components requ for series-derived band-pass filter secti are listed in a series of articles in the " search Worker" published by the Aero Corp., New Bedford, Mass.

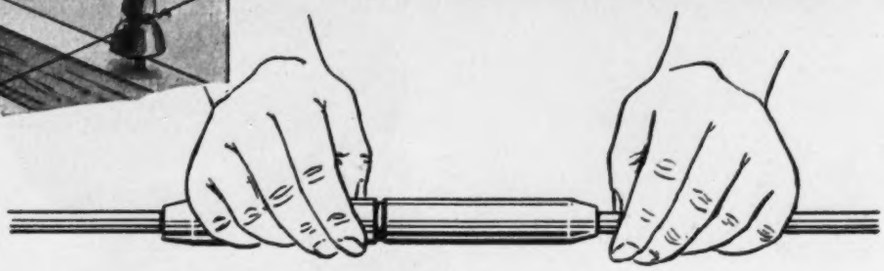
ELECTRONIC TUBES—Operation of m cury-vapor rectifier tubes for half-wave full-wave rectification on single- and th phase circuits, together with maxim typical circuit conditions and maxim ratings for various power and transmit tubes are presented in a series of d sheets "E-E Electronic Tubes" availa from Electronics Enterprises, Inc., Seventh Ave., Newark, N. J.

LUMBER—Uses of pressure-treated l ber in the utility field comprises one s tion of a new book on preserved wood. other section explains the several proce by which lumber is treated to protect against decay, marine borers, termi acids and fires. Copy of the illustra book, "Economical and Permanent C struction with Pressure-Treated Wood," obtainable from Wood Preserving Divis Koppers Company, Pittsburgh, Pa.

CONDENSER TUBES—Effects of ele chemical theory of corrosion, types of p tective films, oxygen and debris, impu ment corrosion, operating conditions other subjects, relating to condensers, exchangers and evaporators, of interes engineers and chemists are discussed i 112-page "Condenser Tube Manual," contains also steam notes, methods of stalling and packing, cutting and remo tubes in condensers. The manual may obtained from Bridgeport Brass Co., Bri port, Conn., by request on your compa stationery.

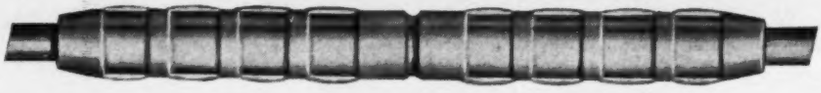


"For My Money I'll Take *Nicopress* Every Time"



THAT'S the verdict of many a lineman after using the Nicopress Method of Splicing distribution lines. These men know that Nicopress meets every requirement for speedily made, trouble-free, neat, uniform line joints.

In making the Nicropress splice the conductors go straight into the sleeve meeting end to end without distortion, overlapping or bending. This not only simplifies the work and increases efficiency and strength of the splice but also conserves material and permits splicing a broken line without changing sag.



Nicopress splices exceed the rated breaking strength of the wire, have a lasting high conductivity, and are so tight the conductors cannot pull out. As all Nicopress power sleeves are bevelled at both ends there's no snagging when pulling the wire over the cross arms.

The Nicopress line includes sleeves for line wires, for splicing wires of different size, and Offset and Suspension Dead-Ends. They are carried in a wide variety of sizes for copper, Copperweld and galvanized wire, solid and stranded.

Order Nicopress From Your Jobber. It's a good investment in economy and security.

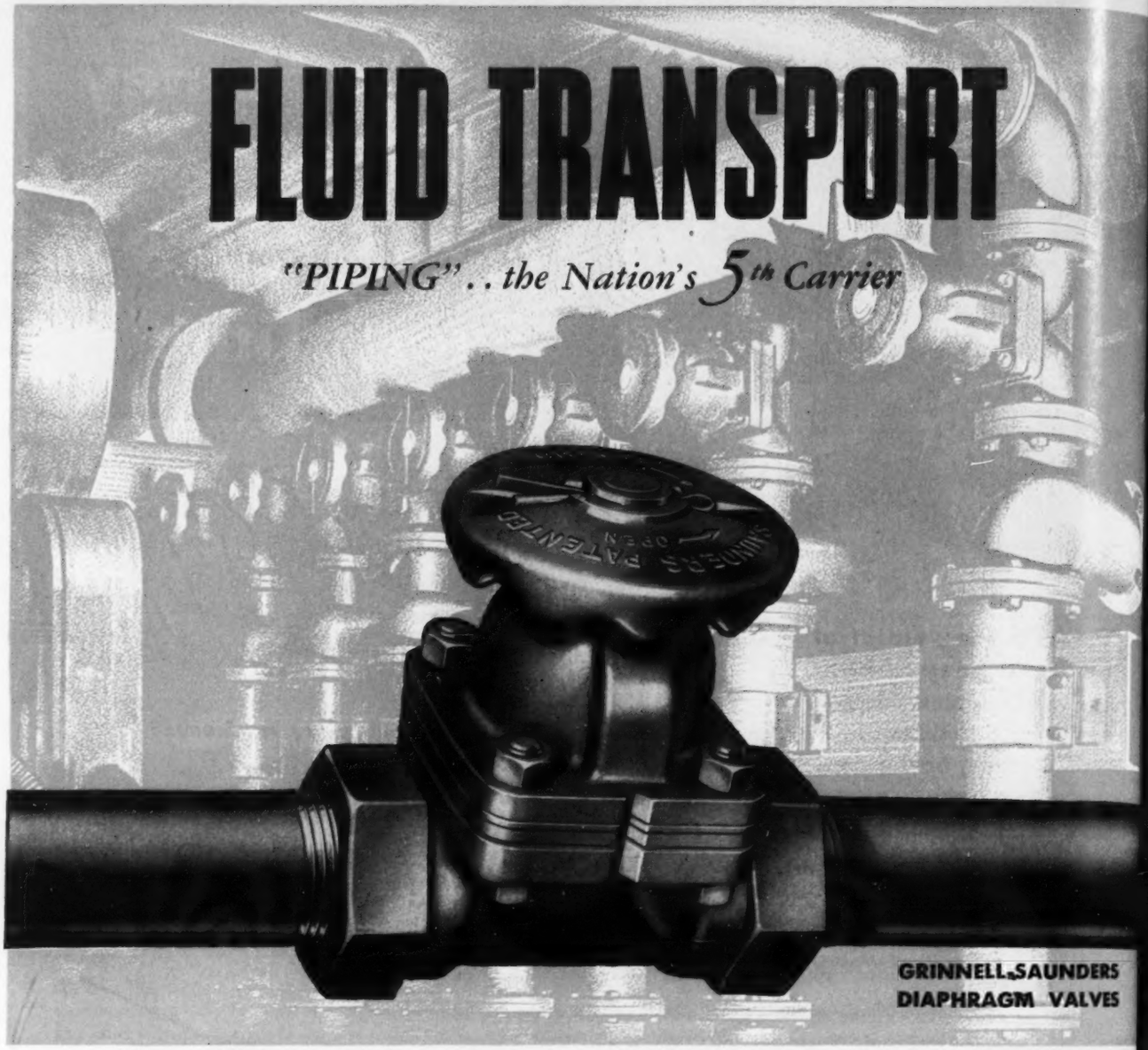
THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.



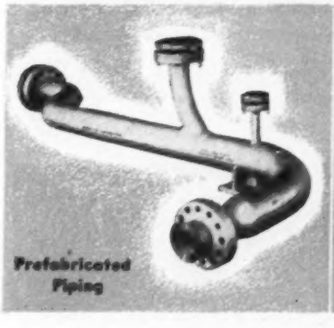
"HOW LONG WILL IT LAST?" is Question No. 1 among specifiers of piping materials for today's process industries. The chemicals to be transported are frequently highly corrosive, so the pipe, valves and fittings selected must be able to withstand their destructive action.

Typical of Grinnell products for this type of service is the Saunders Diaphragm Valve. Its design, permitting a variety of diaphragm materials and body linings to handle each chemical, makes it a long-life valve for process piping. As leading piping engineers and fabricators, Grinnell is furnishing this and other component parts which provide FLUID TRANSPORT in plants producing heavy chemicals, synthetic rubber, food, drugs and the entire range of petroleum product

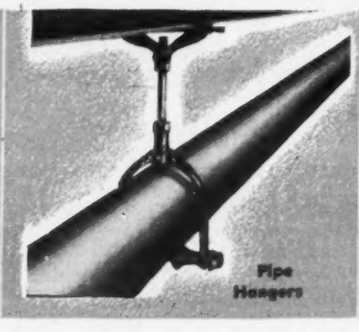
For engineering assistance or piping materials for a type of FLUID TRANSPORT, call Grinnell Compan Inc., Executive Offices, Providence, R. I. Plants a offices throughout United States and Canada.

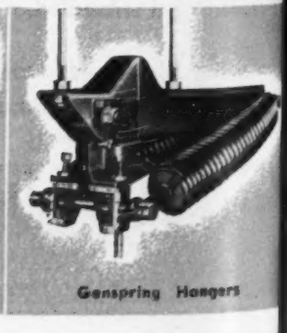
GRINNELL

WHENEVER *Piping* IS INVOLVED


Prefabricated Piping

Pipe and Tube Fittings


Pipe Hangers


Genspring Hangers

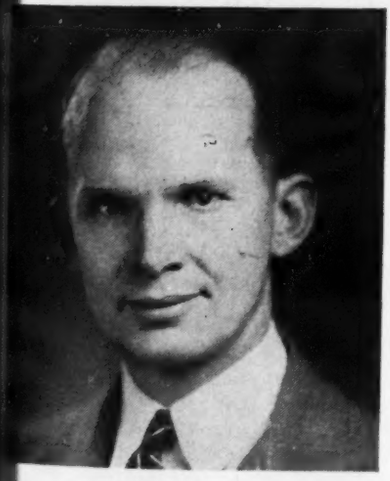
NEWS ABOUT PEOPLE

Westinghouse Assigns New Managerial Duties

Appointment of two new managers in the industry department of the Westinghouse Electric & Manufacturing Co. has just been announced. They are Tomlinson Fort, manager of the central station department, and C. F. Lloyd, manager of the general contract department. Headquarters of both men will remain at the East Pittsburgh plant.

Since February, 1940, Mr. Lloyd has been manager of the central station and transportation department. Mr. Fort has been assistant manager of the same department.

A native of Atlanta, Ga., Mr. Fort joined Westinghouse as a graduate student in 1923, soon after his graduation from New Mexico A. & M. College. After a training period at the East Pittsburgh plant, he was assigned to headquarters sales until 1927, when he was sent to Albany, N. Y., in the company's eastern district. From 1931 until 1940. Mr. Fort was connected with the Westinghouse office in New



T. Fort

York. He then returned to East Pittsburgh as assistant manager of the central station department.

Born in Trappe, Md., Mr. Lloyd was graduated from St. John's College at Annapolis, Md., in 1906 and immediately thereafter joined Westinghouse. He obtained experience in the power correspondence department and high-voltage transmission operations and in 1909 was transferred to the substation section of the railway and lighting department. He then became manager of the electric division in the power department and in 1939 was named manager of the central station sales department. When the transportation sales department was combined with his group, in 1940, Mr. Lloyd was named

C. F. Lloyd

manager of the new operation, known as the central station and transportation departments.

•

▶ HENRY R. KRUSE, formerly manager of the northern division of the Puget Sound Power & Light Co. at Bellingham, Wash., has been appointed head of the company's new economic development and research department. L. J. BOURKE, formerly manager of the company's western division, will supplement the home office executive staff in Seattle. JOHN F. WALLIN, formerly assistant manager of the central division, has been selected to succeed Mr. Kruse as manager of the northern division, and J. HARVEY LEACH, the company's advertising director for the past seven years, replaces Mr. Bourke as western division manager.

Utility Appoints Howard New-Business Manager

J. D. Howard, commercial and industrial supervisor for the Wisconsin Power & Light Co., Madison, who has been "on loan" to the War Production Board since December 15, 1941, has returned to the company as new-busi-

ness manager. He succeeds Paul De Leon, who resigned recently to accept a position with Cleaver-Brooks Co., Inc., Milwaukee.

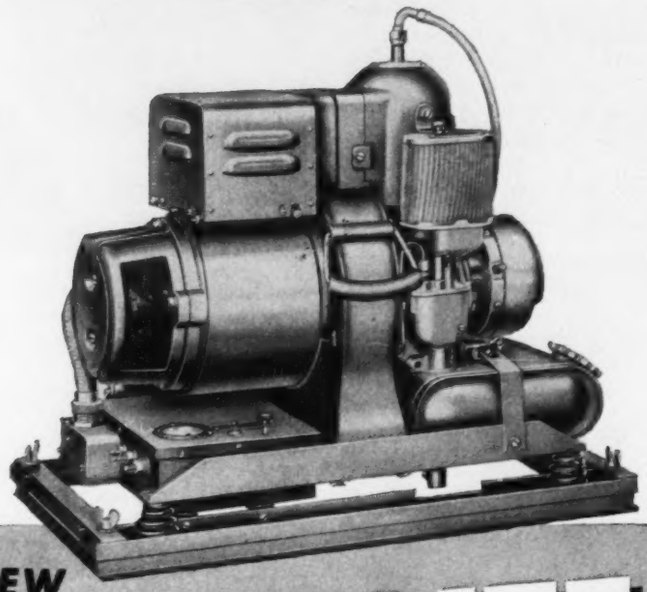
Mr. Howard was graduated from Iowa State College with the class of 1925. Upon graduation he enrolled in the Westinghouse student course in central station sales engineering and remained with the Westinghouse company for nine years. He was stationed in turn at plants in Pittsburgh, Philadelphia, Sharon, in the Chicago district and at the Davenport office. He spent his final year with the company as merchandise supervisor developing dealer outlets.

Mr. Howard joined the Wisconsin Power & Light Co. in 1934 as industrial power engineer in the Sheboygan district. He was subsequently transferred to Madison as commercial and industrial supervisor, the position he held when he entered the WPB service as district manager for 15 Wisconsin counties.

•

▶ F. MALCOLM FARMER, vice-president and consulting engineer, Electrical Testing Laboratories, Inc., and inspection consultant, New York Ordnance District, U. S. Army, has been elected president of United Engineering Trustees, Inc.

▶ JOHN T. NEAL, JR., manager of the Boonton district of the Jersey Central Power & Light Co., has been appointed manager of the Boonton, Dover, Pompton Lakes area. Under the new set-up Mr. Neal will have supervision over the



NEW
HOMELITE
PORTABLE GENERATORS

That's a tough question to answer. The war might last for years. Then again it might end soon. Who knows? Your best bet is to take the optimistic path. Include something in your next year's budget for new Homelite Portable Generators and send in a tentative order. The early orders on our books get first delivery. And it might well be that deliveries will start earlier than you expect.

By the way, the new Homelite units will be worth getting. We've made many remarkable developments in our designs and construction . . . improvements that will benefit you.

ARMY E NAVY

Right now Homelite Workers are Backing the Attack by increasing production and buying War Bonds regularly. After the war, these men and women will work just as hard . . . just as conscientiously . . . for you.

HOMELITE CORPORATION
PORT CHESTER, NEW YORK

three offices, with headquarters in Boo ton. Mr. Neal has had a wide exper ence in this area, having served a manager of the Pompton Lakes distri from 1929 to 1937, when he moved t Boonton as manager. He has been wi Jersey Central since 1925. Mr. Ne attended the University of Pennsylvan and Bliss Electrical School at Was ington, D. C.

•

Eaton to Direct Power Transformer Sale

Temple O. Eaton, assistant manage of power transformer sales at the Pitt field, Mass., works of General Electri has been named manager of powe transformer sales, succeeding E. D Monk, a veteran of 34 years' servi with the company, who will be retaine for consultation and special duties.

Mr. Eaton was born in Virgin

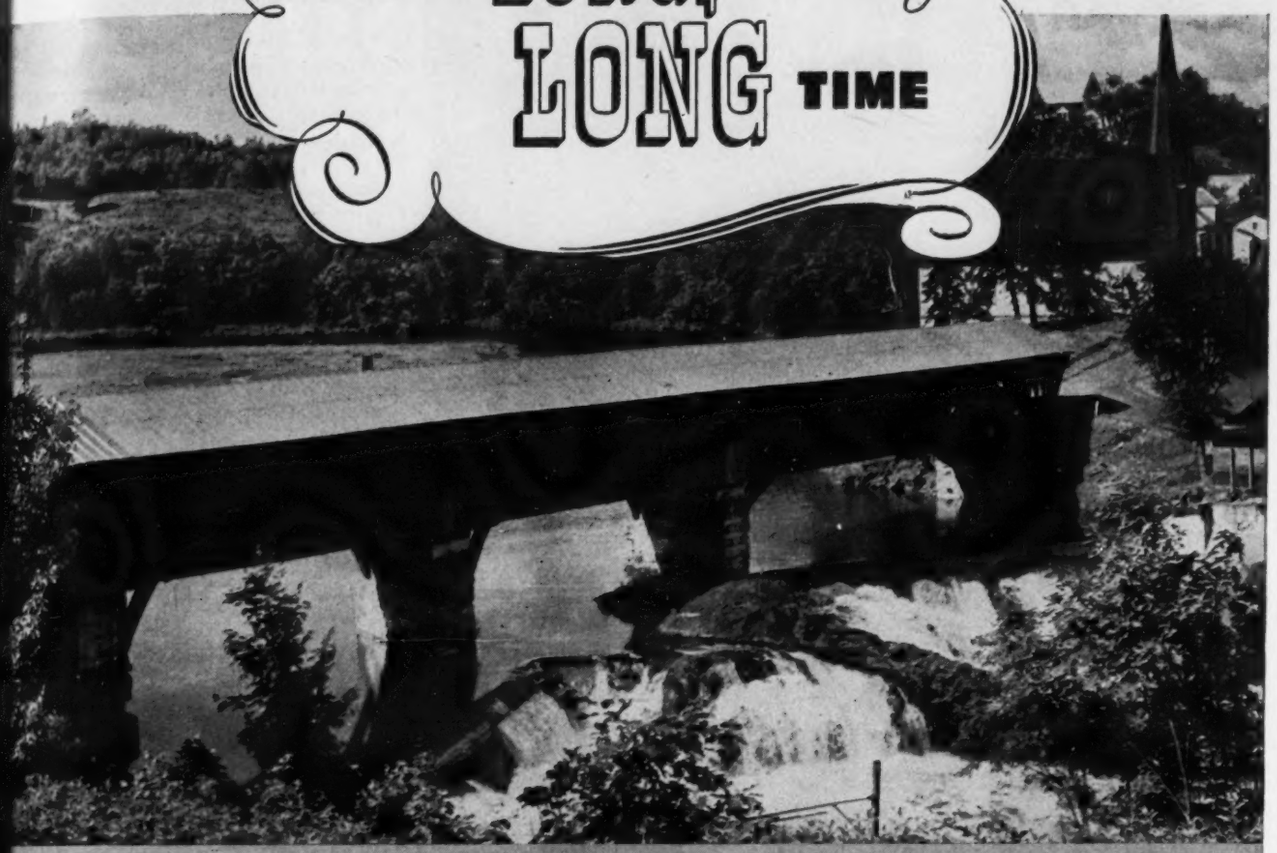
Minn., and was graduated in electri engineering from the University of W consin in 1924. After a year in t drafting section of the Schenectad works he entered the test course the and in 1930 was made a switchgea specialist at Pittsburg. He remain there as a member of the industri sales section until 1938, when he w transferred to Philadelphia. He w to Pittsfield early in 1943.

•

► CHANDLER MURTON, rate engineer the rural and towns division of t Alabama Power Co. for some years, h taken up rate engineering duties in t Birmingham office of the Commo wealth & Southern Corp.

► C. H. SANDERSON, who retired l summer as system planning engin of the Consolidated Edison Co. of N York, has joined the division of w research, Columbia University, N York. Mr. Sanderson's headquart are located in Pasadena, Calif. W

FOR A LONG, LONG TIME



One reason why Tobe Capacitors have forged to the front **is their consistently long life. But there's another reason — the successful pioneering work of Tobe engineers.**

Take as an example the CA—355, shown below in streamlined, hermetically sealed drawn container. It is being used in large quantities by the U. S. Army Signal Corps in front line telephones.

Tobe is the only manufacturer furnishing this capacitor in a drawn container.

The CA—355 is just one instance of Tobe engineering ingenuity in developing and perfecting new devices. However tough your own condenser problems we invite the opportunity for our engineers to help you solve them. Please get in touch with us.

ONG-LIFE ASSURED
For This Unique Capacitor

SPECIFICATIONS—CA—355
Wax impregnated, wax filled capacitor

Capacity Rating:.....2.0—0.5—0.3 mfd.
Voltage Rating:.....200 D C
Power Factor:..@ 1000 cycles .01 maximum
Resistance:....2000 megohms per microfarad
Dimension: 1" depth—2½" length—2⅛" height

Meets requirements of U. S. Army Signal Corps

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

***A small part in victory today*—A BIG PART IN INDUSTRY TOMORROW**

VETERANS OF SERVICE

WARS are no new experience for Mathias Klein & Sons. Years before the first gun was fired on Ft. Sumter, the little forge shop of Mathias Klein was laying the foundation for the manufacture of quality tools that is so much a tradition at Klein's.

When the Victory of Dewey at Manila thrilled the nation, the newly born electrical industry already knew that it could place reliance on tools carrying the name Klein.

Today thousands of electricians and mechanics in the Army, Navy and essential industries are learning that Klein tools give plus service under the tough conditions that war imposes. When the war is won, Klein tools will continue to represent the maximum in service because of the hand-crafted conception of quality that has characterized Klein equipment "since 1857."

ASK YOUR SUPPLIER

***Foreign Distributor:* International Standard Electric Corp., New York**

This Booklet on the care of Tools will be sent to anyone interested.

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

Mr. Sanderson retired he had completed more than forty years of service in the electrical industry. He has written extensively on electrical subjects and is editor in chief of "American Standard Definitions of Electrical Terms." He is a fellow of the American Institute of Electrical Engineers.

▶ JOHN RIEVES, traffic manager and assistant purchasing agent of the Southwestern Gas & Electric Co., Shreveport, La., has been appointed general purchasing agent of that utility to succeed JAMES H. MACBETH, retired. Mr. Macbeth had been general purchasing agent for the company since 1925.

▶ JOSEPH SHUBER has been appointed chief engineer at the Manitowoc steam plant of the Wisconsin Public Service Corp., to succeed GORDON NEIDER, who has transferred his interests to San Antonio, Tex. Mr. Shuber has been identified with the company since 1919 and has been serving as assistant chief engineer at the plant.

▶ I. R. WEIR has been appointed assistant to the designing engineer of the transmitter division of General Electric Co.'s electronics department. In this capacity Mr. Weir will assume complete responsibility for the engineering and drafting activities at the Syracuse, N. Y., plant of the division, where he will be located. Mr. Weir entered the General Electric Co. test department in Schenectady in 1921, and two years later was assigned to what was then the transmitter division of the radio (now electronics) department, where he has been since with the exception of one year, 1924, when he was sent to Central America to install high power radio equipment for the United Fruit Co. Mr. Weir was made section leader of the high power section of the transmitter division at Schenectady in 1929.

▶ ERNEST R. ACKER, president of the Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., was doubly honored by the gas industry at the annual meeting of the American Gas Association held recently in St. Louis, Mo. He was elected president of the association and received the Charles A. Munroe Award for having made the most outstanding recent contribution toward the advancement of the gas industry. It is the first time in the history of the national association that any individual has received both honors in the same year. In presenting the award, the highest recognition given by the association, Arthur F. Bridge, retiring president of the association, said: "Mr. Acker has unselfishly and unstintingly served the gas industry and the American Gas Association as a director, chairman and member of many important committees, as its treasurer for several years, and

CROUSE-HINDS
Gauge Lighting
CONDULETS

- **A complete line**—to meet every gauge lighting requirement.
- **Vaportight** gauge lighting Condulets for use in all indoor and outdoor locations where exposed to corrosive vapors, moisture, rain, smoke, or non-explosive dusts and gases.

  Fluorescent lamps, Lumiline lamps or incandescent bulbs.

  Round window or **light slots** 6, 13, 18, or 24 inches long.

  Two or more units may be **tandem mounted** to give a continuous shaft of light.

  Listed in Condulet Catalog No 2500 Section 25, Pages 17 and 18

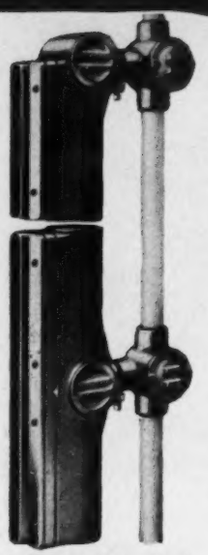
- **Explosion-Proof** gauge lighting Condulets for use in Class I, Group D, hazardous locations.

  Fluorescent lamps, Lumiline lamps or tubular lamps.

  Light slots 7, 14, or 17 inches long.

  Two or more units may be **tandem mounted.**

  Listed in Condulet Catalog No 2500 Section 85 Page 16A



Type ELG Explosion-Proof
Tubular Lamps
7 and 14-inch Units
Tandem Mounted

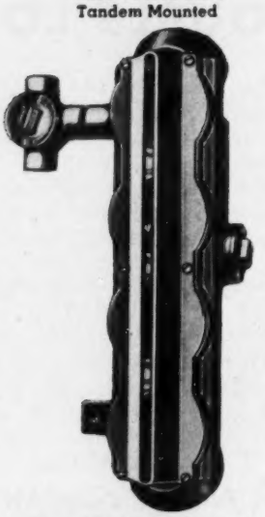
- **For ordinary locations**— Type LG gauge lighting Condulets for use wherever vaportight or explosion-proof fixtures are not required.

  Incandescent bulbs.

  Round or rectangular light opening, horizontal slot or vertical slots 5, 8½, or 13 inches long.

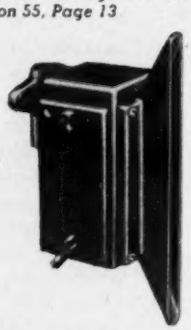
  Installed with rigid conduit, round flexible cable, flexible conduit or armored cable.

  Listed in Condulet Catalog No. 2500, Section 55, Page 13



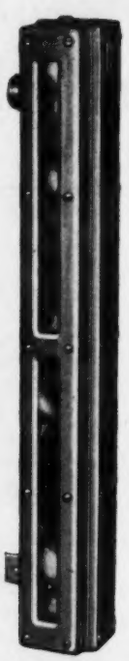
Type ELG Explosion-Proof
Fluorescent or Lumiline

Type LG With
Hooded Rectangular
Light Opening



Type VFC Vaportight
With Flanged
13-inch Slot

Type VLG Vaportight
18-inch Unit
Fluorescent or Lumiline



Type VLG Vaportight
24-inch Unit
Lumiline

A Nationwide Distribution Through Electrical Wholesalers

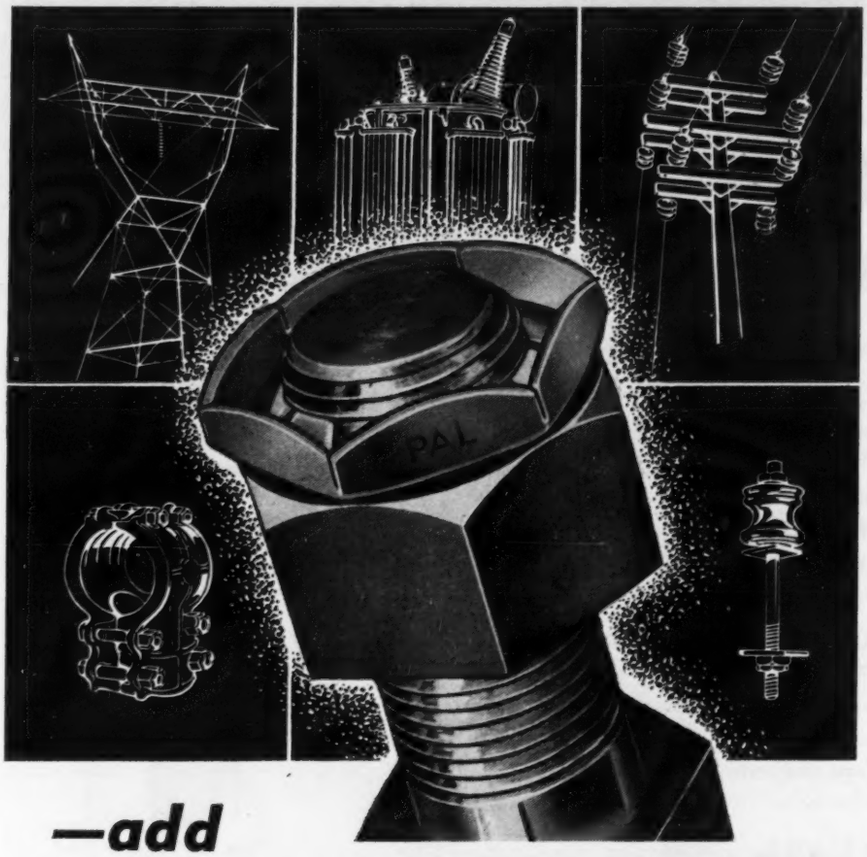
CROUSE-HINDS COMPANY
SYRACUSE, N. Y., U.S.A.

Offices: Birmingham — Boston — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington

Resident Product Engineers: Albany — Atlanta — Charlotte — New Orleans

CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

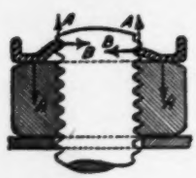
Where Assemblies MUST stay tight—



—add DOUBLE LOCKING PALNUTS!

Tight assemblies and connections are vital in power transmission, distribution and electrical equipment. Fortunately, there is a simple, effective, low-cost answer to this problem . . . Double Locking PALNUTS, used for years on wood pole lines, steel towers, transformers, switches, bus fittings and connectors and other electrical equipment.

PALNUTS are single thread locknuts, of tempered spring steel or Duronze. Quickly applied on top of regular nuts, they hold parts to original tightness, despite severest vibration. PALNUTS are light in weight, low in cost, require only 3 bolt threads space, may be re-used. Specify PALNUTS on equipment you buy—use them on equipment you build. Write for PALNUT Manual No. 1 giving full details.



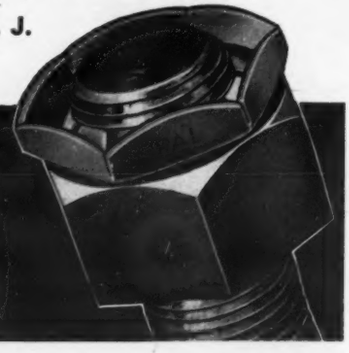
DOUBLE LOCKING ACTION

When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt thread like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY **51 Cordier St.**
Irvington, 1, N. J.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

DOUBLE-LOCKING **PALNUTS**

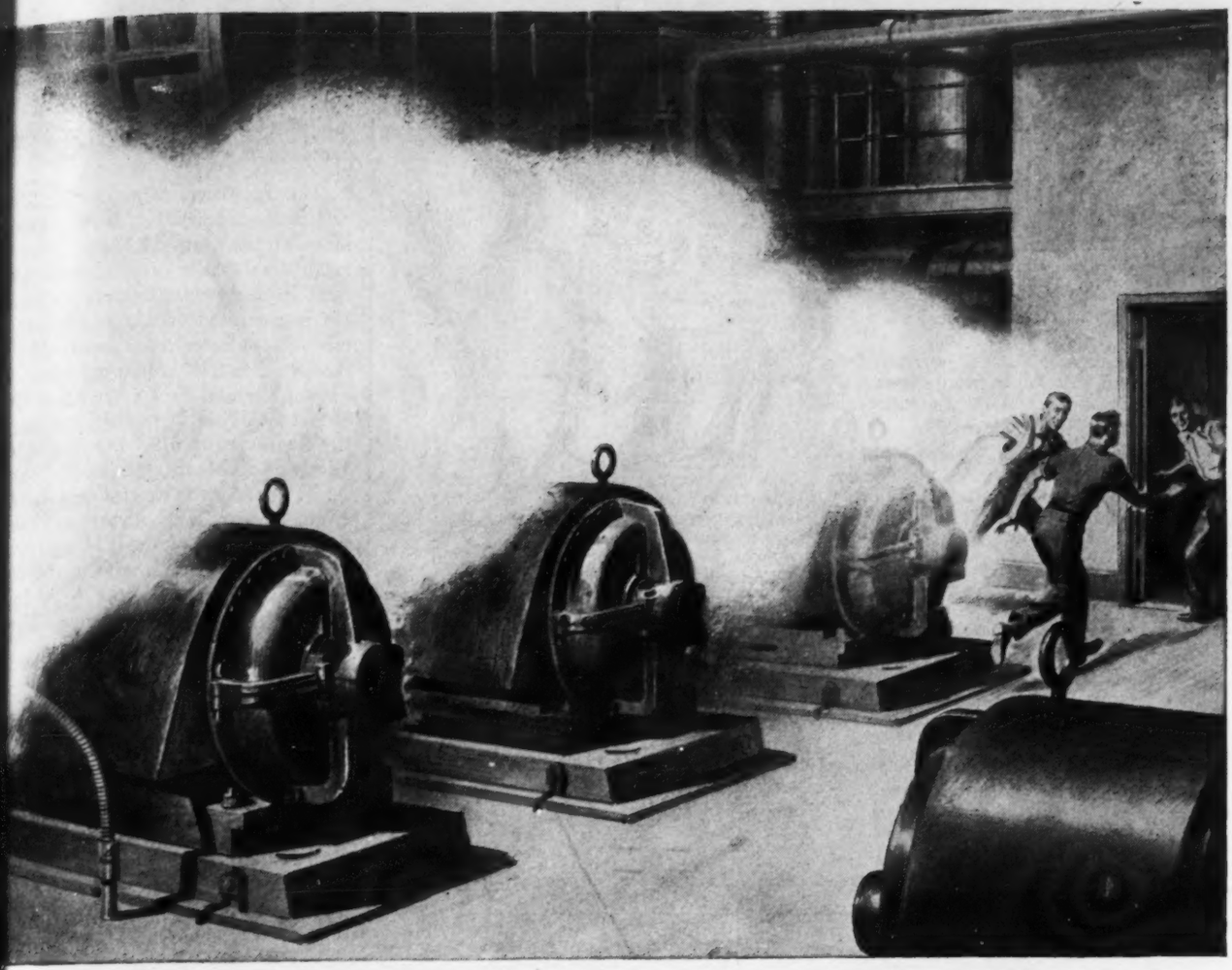


during the past year, as vice-president and chairman of the all-important committee on war activities. In the latter capacity he has sacrified personal comfort, time and energy in his efforts to look after the interests of the gas industry to the end that we might give our best toward winning the war. . ." In 1936 Mr. Acker served as president of the Empire State Gas and Electric Association. He is a member of the operating committee of the Edison Electric Institute.

▶ R. J. Russell, vice-president and sales manager of the Century Electric Co., St. Louis, has been elected president of the Associated Industries of Missouri. The Associated Industries of Missouri is an organization devoted to the promotion of fair business and employee relations policies among employers and employees in Missouri industries.

▶ M. P. Nickerson has been appointed general apparatus and supplies manager of the Westinghouse Electric Supply Co. with offices at the company's headquarters in New York. Mr. Nickerson will have complete responsibility for the development, co-ordination and promotion of apparatus business nationally. He became identified with Wesco at Boston as stores manager in 1925. Five years later he was appointed assistant sales manager in Cleveland and in 1932 he was transferred to the eastern district, New York, as assistant to the district manager. It was in 1937 that he moved to headquarters and was put in charge of syndicate business for the company. When Wesco's marine fittings business began to show volume Mr. Nickerson assumed charge and steadily developed the program until his recent promotion.

▶ Ralph E. Kruck has been appointed manager of the product design department of the Westinghouse electric appliance division. An industrial designer for Westinghouse since 1931, Mr. Kruck will devote his attention to "appearance-designing" electric ranges, automatic laundering machines and all other appliances the company builds after the war. His headquarters will be at the company's plant in Mansfield, Ohio, working closely with the engineering, sales and advertising departments. Before assuming his new position Mr. Kruck was a member of the engineering department at the Westinghouse East Springfield, Mass. plant where he designed household and commercial refrigeration and air-conditioning equipment and even factory buildings and auditoriums. His appliance designs earned him the Westinghouse Order of Merit two years ago. As



Why the engineer was only partly right

THE SUPERINTENDENT of the power station was examining his monthly report.

"Pretty good record of performance," he said to himself.

Certainly, local war plants had increased their demands for power, but to date all their requirements had been met . . .

Suddenly, a roar followed by a tremendous hissing sound came from the vicinity of the steam generator plant. The superintendent dashed from his office.

When he reached the power plant, the steam was pouring into the boiler room. This room contained six 700 H.P. induction motors to supply air for the main boilers.

"It looks bad," shouted an assistant engineer. "They're turning off the steam, *but the motors can't take that kind of heat.*"

But, the story doesn't end there. It later developed that the engineer was only partly right. Only four of the motors failed. The other two were able to keep the plant in operation, at reduced capacity, because these two motors had previously been wound with Fiberglas* Electrical Insulation.

* * *

Here is an actual instance of the superior heat-and-moisture resistance of Fiberglas Electrical Insulation.

This insulation, used with proper impregnant is also proving its ability to withstand high temperatures caused by today's severe overloading of motor and generator.

Serving the Services

These are some of the reasons why Fiberglas Electrical Insulation is being so widely used today by the Army and the Navy and War industries for many types of motors, generators and transformers . . . for wire and cable in planes, tanks, and ships.

As the production of Fiberglas Insulation is being constantly increased, more and more of this material is becoming available for more applications.

Ask your electrical distributor for technical data on Fiberglas Electrical Insulation and about its availability for your use. Or write: *Owens-Corning Fiberglas Corporation, Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

ARMY E NAVY

FIBERGLAS

*T. M. Reg. U.S. Pat. Off.

ELECTRICAL INSULATIONS

Hundreds of Spots for Micro Switch in a Utility System

There are hundreds of utility applications for Micro Switch. Its precise operation, close adjustment and long life make it fit the most exacting applications.

Illustrated here is the use of three Micro Switches on a remote draft position indicator. They are operated by a cam on the draft shaft, and make contact at "open," "half," and "closed" positions.

Micro Switches are supplied in a wide variety of housings and a broad range of actuating mechanisms to fit any application where a precise, snap-action switch is required.

The basic Micro Switch is a thumb-size, feather-light, plastic enclosed, precision snap-action switch that operates on force differentials as low as ¼ ounce, and movement differentials as low as .0002". It is listed by Underwriters' Laboratories with ratings of 1200 V.A. loads from 125 to 600 volts A.C.

Ask for Micro Switch Handbook-Catalog No. 60 for complete details.

Micro Switch Corporation, Freeport, Ill. Branches: 43 E. Ohio St., Chicago (11) • 11 Park Place, New York City (7) • Sales and Engineering Offices: Boston • Hartford • Los Angeles

© 1943

This trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation

MICRO SWITCH

Made Only By Micro Switch Corporation . . . Freeport, Illinois, U. S. A.

Here, at Doolittle, we are coordinating every effort and skill to help provide the communications equipment so essential for Victory. This will mean better peace-time communications after our battles are won.

To Assure Victory
Buy More U. S. War
Bonds and Stamps

Doolittle
RADIO, INC.

Builders of Precision Radio Communications Equipment
7421 S. Loomis Blvd., Chicago, U. S. A.

pointed to take Mr. Kruck's place the Westinghouse plant in East Spri field was ANTHONY NAIDEN, a desi engineer who has been associated the past eight years with advertisi agencies of New York.

▶ JACK L. ROWE, formerly transform and ballast specialist in the Chica office of the General Electric Co., h established a new sales agency, speci izing in fluorescent lighting accessori He has announced his appointment midwestern sales representative for Kulka Electric Manufacturing C Mount Vernon, N. Y.; the Abott Flu escent Co., New York City, and also the fluorescent ballast line of the Ac Electric & Manufacturing Co., Cat N. Y. Mr. Rowe is a graduate electri engineer from the University of Illino and a member of the Chicago secti of the Illuminating Engineering Socie His new office is in the Civic Op Building, 20 N. Wacker Drive, Chica

▶ MICHAEL N. BRADY has been a pointed vice-president in charge of sa of the National Enameling & Stampi Co., Milwaukee. For the past thirte years Mr. Brady has been associat with the U. S. Rubber Co. He start with that organization as district sal manager, Birmingham, Ala., in 19 Successively he has held similar sa positions in Syracuse, New York, Bal more, St. Louis and Chicago. He r signed the position of central divisi sales manager, Detroit, to join the N tional Enameling & Stamping Co. recent months Mr. Brady was un assignment by the U. S. Rubber Co. complete the personnel organization some 20,000 employees at the Sci Ordnance Plant at Marion, Ohio. A nouncement was recently made by t company of the return of DALE D. K STAEDT in the capacity of advertisi manager. Mr. Karstaedt has return to the position in Milwaukee he he from 1936 to 1938, from the Rad *Journal*, where for more than five ye he has been advertising manager.

▶ LOUIS S. CATES, president of Phe Dodge Corp., has been elected a member of the Massachusetts Institu of Technology Corporation. An M.I graduate of 1902, Mr. Cates has be active in the affairs of the engineer school for many years. He previou served as a member of the M.I.T. cor ration from 1933 to 1938.

▶ HARRY A. ERB has joined the staff the Worthington Pump & Machine Corp., Harrison, N. J., as service m ager of the Moore steam turbine di sion, Wellsville, N. Y. A graduate Cornell University, Mr. Erb has a bro background of experience, covering t servicing of steam turbines, electr generators and related equipment.

ROCKBESTOS A.V.C.

Maintains Production Schedules with a Permanent Insulation that Won't ROT or BAKE BRITTLE

Baking, withering heat causes more failures in circuits running around furnaces, lehrs, kilns, steel mills, power plants, steam tunnels, etc., than any other trouble maker. It dries out the insulation, opens cracks to moisture, sets up shorts, rewiring jobs, equipment and production outage—unless the wire is *permanently insulated* like Rockbestos A.V.C. This construction with its laminated asbestos and varnished cambric insulation, covered with a tough asbestos braid, won't bake brittle, crack, swell, flow or rot under heat and is also resistant to moisture, oil, grease, corrosive fumes and flame. Other Rockbestos wires, cables and cords designed for severe operating conditions are available in our line of 122 standard constructions. For information or recommendations write to nearest branch or:

Rockbestos Products Corp., 918 Nicoll St., New Haven 4, Conn.

For Victory—Invest in U. S. War Bonds

Why Rockbestos Permanent Insulation Prevents Premature Wire Failure

Rockbestos A.V.C. Power Cable, illustrated*, 600 to 5000 volts, No. 18 A.W.G. to 1,000 MCM, Underwriters' and N.E. Code, Type AVA, maximum operating temperature 110°C., has this permanently insulated construction.

1. The conductor is permanently centered in helically applied insulation that will not flow, migrate, dry out, crack or rot.

2. Felted asbestos insulation withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

3. Lubricated varnished cambric for high-dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4. Felted asbestos insulation impregnated with heat, flame, and moisture-resisting compounds will not dry out, become brittle, or burn. Also serves as a heat-barrier against high ambient temperatures.

5. A tough, rugged impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

**One of 122 different wires and cables developed for severe operating conditions by Rockbestos.*

RESISTS moisture, oil, grease and fumes.
WON'T bake brittle, burn, flow or rot.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

Molten Metal Sprayed on Wood Patterns Prolongs Their Life

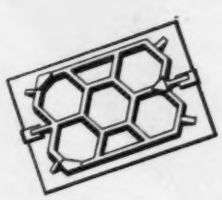
Molten metal sprayed on wood foundry patterns by a compressed air gun provides a protective coating against sand wear on the finished surfaces, thereby prolonging the life of the pattern and eliminating costly repairs.

The metal may be sprayed directly on the untreated wood surface of the pattern or core box. If the wood surfaces are hard or close-grained, a shellac primer is first applied, the metal being sprayed on before the shellac dries. The thickness of the metal coating is about 5 thousandths of an inch.

The spraying equipment consists of a portable, self-contained gun-type sprayer which melts the metal and is thermostatically controlled.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information about this method from Alloy-Sprayer Company, 2039 Book Building, Detroit, Michigan.



This wooden pattern coated with sprayed metal, has given service far beyond its normal life.

Fine detail easily recorded in the alloy sprayed onto pattern.

X-58

OBITUARY

Thomas Bragg

Thomas Bragg, vice-president a director of the Alabama Power C and widely known throughout Alaba as a business and civic leader, died October 30 in Houston, Tex., after operation for acute appendicitis pe formed on October 17. He was 62 yea of age. Mr. Bragg was married October 16 to the former Mary Pry Prowell, Richmond, Tex., and his s

den illness prevented a planned hone moon trip to Mexico City.

A native of Camden, Ala., and graduate of Alabama Polytechnic Ins tute, Mr. Bragg was a professor Auburn and faculty manager of a letics for many years. In 1920 he came associated with Alabama Pow Co. and later became vice-president a director of the company.

At the time of his death he w chairman of the Alabama State Salva Committee, a director of the Birmi ham Chamber of Commerce and Associated Industries of Alabama.

•

Hamilton G. Scott

Hamilton G. Scott, for many ye prominently identified with both public utility and manufactur branches of the electrical industry, d on November 1 in the French Hospi in New York, after a week's illness. was 59 years old.

Mr. Scott had a remarkable rec as a builder of properties. Born Paterson, N. J., he entered upon career in the electrical department the Rogers Locomotive Works in 1 and by 1911 he was in charge of po contracts in Atlanta for the Cen Georgia Power Co. One of his standing achievements was the build from practically nothing of the Virgi

wer Co. into an excellent operating perty. He occupied the position of e-president and general manager. er World War I he organized the dicate which purchased and devel- d the government powder plant at ro, W. Va. The town was built by government during the war as part he line of defense behind the Ap- achian Mountain, and when the war pped it was deserted and left in use. Mr. Scott took this useless perty and built an organization to the war material and transform the le property to peacetime uses. He le an outstanding success of this ertaking.

rom Nitro, Mr. Scott transferred interests to the Columbia Gas & tric Co., where as vice-president n 1923 to 1925 he was actively en- ed in buying and selling facilities, pping out plans for expansion and anizing the personnel to build the perties of this system. He resigned n Columbia in 1925 to take the irmanship of the board of directors the executive committee of the el Corp. Mr. Scott had retired as usiness executive in 1937, but two rs ago he took over the Pathe Engi- ring & Tool Manufacturing Division he Ley Realty Co., Inc., in Long nd City and converted it to war duction. At the time of his death he a part owner and an officer of this pany.

•

LIVER E. McCORMICK, vice-president he Middle West Service Co., Chi- o, died on October 30 in that city, at age of 51. Mr. McCormick was merly vice-president and treasurer of old Middle West Utilities Co. and surer of its successor, the Middle st Corp.

AMUEL H. TAYLOR, retired secretary he Pacific Coast Electrical Associa- , died October 18, in Oakland, f. He had served 56 years in the stry at the time of his retirement n that position on July 1, 1930. In he was sent to Sacramento, Calif., the Thomson-Houston Company to up and demonstrate 25-light series street lighting circuits. In 1890 he pped and supplied the San Jose & a Clara Railway, which he later ed. He became associated with er & Atwater, Inc., jobbers of rail- supplies, in 1897, and headed its essor, the Electric Railway & Manu- rers Supply Co., until 1920, when ecame a part of the Westinghouse pany. In 1920 he was appointed etary of the Pacific Coast Electrical ciation. He was one of the oldest bers of the San Francisco Electric and widely known in California rical circles.

VICTOR INSULATORS INC
VICTOR, NEW YORK
V
The Mark of Good Insulators . . .

Any Pole can be Pulled or Straightened with this Simplex Jack

No. 329 Pole Pulling and Straightening Jack. Capacity 15-tons; lift 23". Equipped with 10"x24" I-beam base and 8' snubbing chain.

Speed, combined with ease and safety, is the order of the day when poles are pulled, moved or straightened with this Simplex Jack. For many years these sturdy jacks have been saving man-hours and reducing out-of-service hours for utility companies.

Templeton, Kenly & Co., Chicago (44), Ill.
Better, Safer Jacks Since 1899

Simplex
LEVER - SCREW - HYDRAULIC
Jacks

MANUFACTURING-MARKETS

G. E. Plans for Shift to Peace Economy

General Electric Co. announced a definite program for easing the transition from wartime to peacetime production, when it revealed a reservation plan for the purchase of post-war radio broadcasting equipment.

Under the plan prospective purchasers would be required to deposit with G. E. United States war bonds in sums determined by the amount of equipment reserved for post-war delivery.

Paul L. Chamberlain, in charge of sales for the transmitter division, explained that the program is not an order for equipment, nor will the broadcaster have to sign a contract to buy. Under the terms of the plan the broadcaster can place his order for equipment at any time up to 90 days following the date when production and sale of commercial transmitters are authorized. However, to maintain his reserved position, he must enter into a mutually satisfactory sales contract within this 90-day period.

Mr. Chamberlain emphasized that the bonds deposited with G. E. under the plan would remain the property of the broadcasters, as well as all income from them, and will be returned when a contract is signed or at any time the broadcaster wishes to withdraw. In the latter case, however, he would lose his priority position for equipment.

•

U. S. Rubber Co. Develops New Synthetic Rubber

A new synthetic rubber, the sixth major type to be discovered through chemical research, has been developed by the United States Rubber Co., it was announced by Herbert E. Smith, president.

"Known as Uskol, this new synthetic will be used in both industrial and household products," Mr. Smith said. "As a result of its distinctive properties, it is expected to take its place alongside the present five commercial types of synthetic rubber—buna S, buna N, neoprene, butyl and thiokol.

"Offering a new high degree of resistance to solvents, this new synthetic will be used in the manufacture of commodities which come into contact with fuels, oils, gasoline, dry cleaning fluids and other penetrating chemicals which are the enemies not only of natural rubber, but of the other five synthetic types. It will also be used for specialties such as industrial molded items, tubing, gas and oil hoses, tank linings, and for application to paper and cardboard to render them resistant to grease, water and chemicals.

•

Army-Navy "E" Awards

Among the industrial plants that have recently won the Army-Navy award for outstanding performance are: Landers, Frary & Clark, New Britain, Conn.; York Corp., York, Pa., and National Enameling & Stamping Co., Jacksonville branch, Jacksonville, Ill. For continued "meritorious services on the production front" the Storage Battery Division of Philco Corporation, Trenton, N. J., has been awarded a second star to add to its "E" flag.

TRACKING DOWN VIBRATIONS—A new vibrograph, developed by Westinghouse Research Laboratories, measures and records machinery vibrations in the range from 60 to 15,000 cycles per minute. Inclosed in a small box, and weighing only 8½ pounds, it can be used by placing it on the vibrating body, or hand-held through the use of a prod. Its primary use is in connection with turbines, motors and motor-generator sets

•

Sees Vast Post-War Home Consumption

Home consumption of electrical power likely will at least double its present rate during the post-war era, a housing executive of the Westinghouse Electric & Manufacturing Co. forecast recently. This is indicated because of the flexibility, low cost and certain abundance of electricity for home uses and the fact that new homes will be completely electrical, Irving W. Clark, manager of the Westinghouse Better Homes Department, said in a speech to the Missouri Valley Power Association meeting at Kansas City, Mo. Mr. Clark cited these factors:

At the conclusion of the war electrical energy production will be at an all-time high. The homes of America are a logical consumer of these surplus kilowatts.

The flexibility of electricity's domestic uses, the many functions it performs from lighting to heating, to cooking, to food preservation, to laundering, to the bringing of educational and entertainment programs to the average fireside through the radio and television, make electricity the greatest home servant that man has ever known.

New electrical products, the speaker advised the power company representatives, are bound to be the result of the tremendous strides that have been produced by scientists and technicians in the war effort. Innumerable items using electrical energy in the war effort will be converted to peacetime home uses.

A vastly increased number of electrical appliances will become a part of every American's daily life, Mr. Clark said, adding that saturation point of existing appliances will under the proper stimulation spiral upward at a rapid rate.

The prefabricated dwelling manufacturer, large-scale development builder and general contractor all will occupy prominent roles in post-war housing, Mr. Clark forecast. The speaker estimated that there was an actual need of at least 1,000,000 new homes a year for ten years or longer after the war if we are, as a nation, to hold our own in the housing requirement field.

•

Vote Alcoa Share Rise

Stockholders of the Aluminum Co. of America have voted to increase the authorized common stock from 1,500,

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Landing barge tieup solved overnight

Swift Action By Wesco Sped 3,000 Correct Cable Clamps To End Production Halt

The landing barge manufacturer was "on the spot". The wrong type of cable clamps had been ordered and production of the critical invasion craft had been stopped until the correct clamps could be procured.

The local Wesco man, contacted, responded immediately. In a few hours, sketches had been drawn of the exact type of clamp needed. The next afternoon, after a 750-mile plane trip, the Wesco man sat in conference with the clamp manufacturer. That evening the plant was kept open, dies were revised and the 3,000 clamps manufactured and inspected before dawn. The morning air express flew them to the landing barge manufacturer.

Alertness, wide contacts and dependable sources of supply enable Wesco to "come through" in war production emergencies. When the Big Job is done, Wesco facilities again will be at your service to help you convert rapidly and economically to the products of peace.

WESCO SPEEDS WAR PRODUCTION

* An emergency night shift on a hydro-electric dam needed 12 special lighting fixtures. Best quoted delivery was 60 to 90 days. Wesco designed, assembled and delivered 12 "hand-made" fixtures in only 6 hours!
* Fifty-five miles of conduit were shipped to a war plant 24 hours after Wesco received the order. Best delivery from other sources—5 weeks.

• • •

WESCO SERVES BUSINESS

* By providing engineering service in making up lists of materials and in preparing bids on jobs.
* By knowing local and national codes and rulings.
* By warehousing stocks in anticipation of customers' needs.

GIVE FREELY TO NATIONAL WAR FUND

Westinghouse Electric Supply Co.

150 VARICK STREET . . NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

Available Now
TIME DELAY RELAYS
by Paragon

Used to accurately delay the closing or opening of an electric circuit following a power failure or disconnect of the A. C. operating potential. Or to provide an adjustable time delay between the closing of a pilot circuit and the subsequent closing or opening of the Timer load circuit. Ideal for automatic protection of electronic tube plate circuits against sudden application of power and to preclude overloads on branch motor circuits after power interruptions. Powered by self-starting industrial type synchronous motors, which are not affected by changes in ambient temperature or vibration.

Write for complete catalog of time control instruments today.

PARAGON ELECTRIC COMPANY
407 SOUTH DEARBORN STREET
CHICAGO 5, ILLINOIS

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1903

000 to 7,500,000 shares and authorized the directors to dispose of the new shares "for consideration of such character and value as the board shall from time to time fix or determine."

•

Cutler-Hammer Net Increases in 1943

Net profit of Cutler-Hammer, Inc., for the nine months to September 30, after $6,641,561 taxes and $1,000,000 post-war adjustment reserve, was $1,530,569, or $2.32 a share, against $1,020,702, or $1.55 a share after $5,882,806 taxes and $450,000 post-war reserve, last year.

Among other electrical manufacturing companies issuing earnings statements for the nine-months period or for the third quarter are the following:

BLAW-KNOX—Including subsidiaries, nine months to September 30, net profit, $1,153,132, or 86 cents a share, compared with $711,179, or 53 cents a share, last year. September quarter, net profit, $372,404, or 28 cents a share, compared with $370,964 or 28 cents, for June quarter this year.

GENERAL CABLE—Nine months' net income, after $6,575,000 taxes was $1,609,150; against $1,797,302 net income for 1942 period, when $10,605,000 was provided for taxes.

•

Two New Plants Acquired by Sylvania Electric

A five-story building in the center of Williamsport, Pa., is soon to be converted to the production of electronic manufacturing and testing equipment for Sylvania Electric Products, Inc. Formerly a furniture factory, the new establishment is the eighteenth plant of the company.

Announcement was recently made by the company of the acquisition of a new plant for the manufacture of radio tube parts at Wakefield, Mass. This unit is already in production.

•

Elliott Co. Plans Stock Sale; Files With SEC

Registration statement covering 52,957½ shares of common stock of the Elliott Co., Jeanette, Pa., has been filed with the Securities and Exchange Commission, F. Eberstadt & Co. being named as underwriter. Public offering, expected some time this month, will represent the first distribution to the public of securities of the company.

No new financing is involved, as a substantial proportion of the shares offered are being acquired from a trust estate and the balance from certain other stockholders.

BEN-HUR TRAILER ENGINEERING applied to your post-war plans may show you, too, new uses for handy trailer units—to move tools to the job, to mount vital machine units, carry supplies and materials, or for mobile service units.

Take advantage of Ben-Hur's experience in trailer design and engineering to help YOU to new progress in post-war business planning.

Write for our data sheet to aid your post-war planning.

Awarded Army-Navy "E" for excellence of war production.

BEN-HUR MANUFACTURING CO
634 East Keefe Ave., Milwaukee 12, Wis.

BEN-HUR
INDUSTRIAL TRAILERS

Field Reports on Business

...vy and merchant marine requirements for electrical supplies for outfitting ...ssels continue high and include heating devices of all kinds. Radio com...unication apparatus is an outstanding feature in the market for electrical ...ecialties. Orders for fluorescent lamps are stepping up. Retail trade con...ues at a high level.

NEW ENGLAND

...he demand for electrical supplies ...ed for outfitting naval and merchant ...ine vessels continues fairly strong; ...ll motor sales to machine tool builders ...dropping off; wiring supplies for light... in buildings under construction at ...l and army bases are moving at a good ... and more attention is being directed ...rd post-war change-over in industries, ...ough specific plans have as yet not ... divulged. There is a brisk demand ... the Navy for all kinds of heating ...ces, including electric ovens; glue ...ing-pots, of which 10-gallon capacity ...s were bid on last week by a Massa...setts manufacturer, and for overhead ... portable types of electric air heaters ...ch are taxing the capacity of local ...nufacturers. Radio communication ap...atus continues an outstanding feature ...he market for electrical specialties; a ...necticut manufacturer has submitted ... for electric washing machines to be ... on naval vessels, and electrical equip...t manufacturers are carrying substan... orders for plastics in non-electrical ap...ations as well as the usual electrical ...

...he demand for both fluorescent and ...ndescent lamps is strong. Last week ...order for 480 fluorescent lamps was ...ed and buying of incandescent lamps ... institutions for winter is stepping up. ...re is still a sizable amount of new con...ction going on in this district, some ...porary, and some of a permanent type. ...nded is an optical shop and trainin... ...ol which should involve electrical ...ipment used in connection with pre...on machinery to be constructed at a ...necticut naval base at a cost of $68,913, ... Peaslee, Hartford, Conn., being the ...tractor.

CHICAGO

...ehring Electrical Works, De Kalb, Ill., ...l now fabricators of bare and weather... ...f copper wire and cable exclusively, ... recently received several sizable orders ... aluminum power transmission cable ... both utilities and government agencies. ...minum for cable fabrication at the ... Kalb works is being furnished by the ...minum Company of America under ...B authorization. Shipment of the fin...d conductor was scheduled to begin ... in November.

...econd 80,000-kw. turbine at Port Wash...on station of Wisconsin Electric Power ... was placed in operation October 30. ... new unit, costing over $7,000,000, ...es the company's generating capacity to ...500 kw.

...dustry continues to expand in this ... In October expenditures for in...sed plant capacity totaled $6,348,000, ...ging the total since January 1 up to ...9,949,937.

...ampson Electric Co. here has received ...avy Department order for "ammeters, ...iammeters, kilovoltmeters and volt...ers" in undisclosed number and value. ...o from the Navy, Edison General Elec... Appliance Co. is reported as receiving ...rder for galley ranges and spare parts. ...solidated Radio Products Co. is supply... 3,000 Navy-type telephone headbands. These and other non-electrical contracts made up the 75 war orders received by 63 Chicago area firms during the week ended October 28.

NEW YORK

WPB plans for erecting additional aluminum facilities in New York City have been scrapped, it was learned recently. The program contemplated erection of an aluminum reduction plant capable of producing 175,000,000 pounds of aluminum annually. The new project was to have augmented the plant already in operation in the Maspeth district of Queens, but the easing of the critical aluminum situation has made the addition unnecessary, it was said.

Retail sales continue at a high level, according to reliable indices. The Department of Commerce reports that the September retail sales index showed a gain of 6 percent over the corresponding month last year, but consumers' durable goods fell off 8.5 points, compared to a general gain for all stores of 13.5 points. Department store sales nationally for the week ended October 30 were 10 percent above sales of the corresponding week in 1942, while the increase for the four-week period was 11 percent.

Civil engineering construction volume totaled $35,206,000 for the short week due to the election day holiday—74 percent below the week last year. The current week's construction brings the 1943 total to $2,716,958,000, which, on a weekly average basis, is 67 percent below the $8,461,997,000 reported for the 45-week period in 1942, according to the *Enginering News-Record*.

PACIFIC COAST

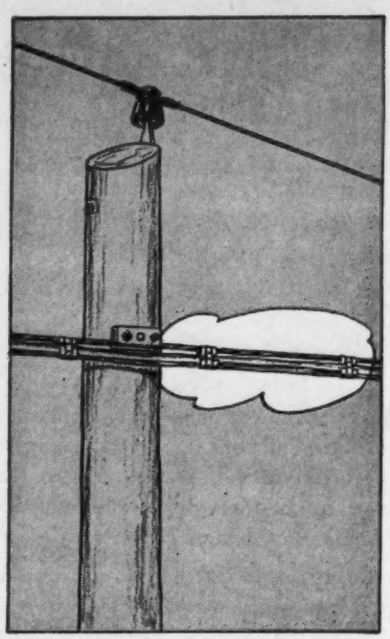
Coast wholesalers report that some of their suppliers are announcing that, for the first time since early 1942, they are able to accumulate stocks on hand. This is partially due to gradual adjustment to wartime conditions, but no doubt owes something to completion of government contracts. Western stocks are beginning to reflect these conditions and are good except for acute shortages of rubber cords like tirex and industrial wiring devices such as twistlock. Rubber-covered wire in house-wiring sizes is also in stock and conduit and fittings are in even better shape.

Seattle and Long Beach are leading all coast cities in spending income per capita, just as coast cities are leading the rest of the country.

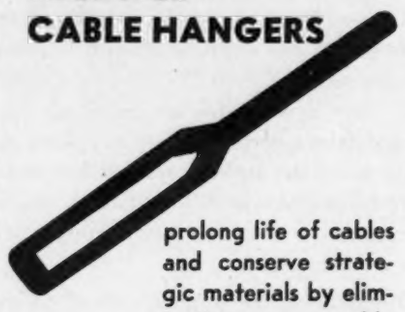
New and prospective orders include a low bid of $20,820 from Bowie of disconnect switches for Bonneville System, traffic signals for Oakland, a large lighting job for Navy in San Diego, a vertical electric furnace for a tractor firm, $110,000 power apparatus and cable for a floating dry dock and a $46,997 low bid for Bonneville pole line hardware.

Outstanding is award of 17 cargo ships, 168 ft. long, to United Concrete Pipe Co. of Los Angeles, and the outstanding electrical order also covers marine material, consisting of complete sets of anchor and windlass controls, also panels and switchboards, aggregating $430,000 for six cargo carriers in Bay area.

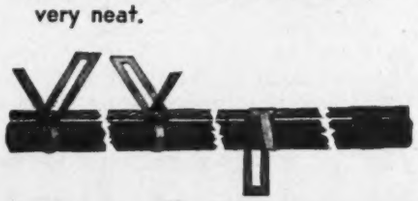
Reduce Outages
Avoid Cable Wear
Reduce Maintenance



RELIABLE
CABLE HANGERS



prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat.



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★ Here's how you—yes, YOU—can carry out a smashing "pincer movement" against the Axis. Swing in on one flank with increased production of war goods! Drive in on the other with redoubled purchases of War Bonds through your Pay-Roll Savings Plan!

You're an officer in both of these drives. Your personal leadership is equally vital to both. But have you followed the progress of your Pay-Roll Savings Plan as closely as you have your production?

Do you know about the new Treasury Department quotas for the current Pay-Roll Allotment Drive? *Quotas running about 50% above the former figures?* You see, these new quotas are based on the fact that the armed forces need more money than ever to win the war, while the average worker has more money than ever before to spend. Particularly so, on a *family income* basis—since in so many families several members are working, now.

Remember, the bond charts of today are the sales curves of tomorrow! Not only will these War Bonds implement our victory—they'll guard against inflation, and they'll furnish billions of dollars of purchasing power to help American business re-establish itself in the markets of peace.

So get this new family income plan working at once. Your local War Finance Committee will give you all the details of the new plan. Act today!

This advertisement prepared under the auspices of the War Advertising Council and the U. S. Treasury Department.

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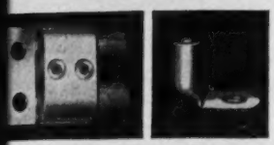

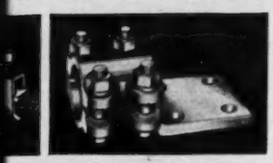

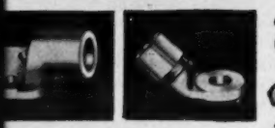

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Discuss Status of Pensacola Dam

Federal-state discussions as to the future status of the Grand River (Pensacola) Dam, now under control of the Interior Department, were initiated recently by Gov. Robert S. Kerr of Oklahoma, who asked the department when it could expect the dam to be returned to the Grand River Authority, suggested a 1¾ percent cut in the 4 percent interest rate on authority bonds and asked for a determination of the financial tangles which arose out of federal acquisition of the project.

No Agreement Reached

An Interior Department spokesman said Kerr's visit last week did not result in any concrete agreements or action on the matters. He pointed out that the dam must be turned back to the authority after the war under the executive order which recently transferred it from the Federal Works Agency, which took it over about a year ago, to Interior. Meanwhile, he said, the Federal Power Commission, which is required to set a rental figure which the government has to pay the authority while it holds the dam, has not yet set the figure inasmuch as the law under which the federal government took over the project has been turned back. Governor Kerr, he said, suggested that the rental be determined as soon as possible.

Power revenues, which normally would be used to pay interest and amortize the bonded indebtedness, meanwhile, are being sequestered with payment on the bonds, which situation Governor Kerr asked be adjusted as soon as possible.

The Interior Department spokesman said these questions have not yet been determined because the department has only been operating the property since September 1 and has been busy establishing its organization (the Southwest Power Administration). They will require considerable study before they can be settled, he added.

Fort Gibson Urged

Governor Kerr also was understood to have suggested the construction of Fort Gibson Dam on the Grand River below Pensacola, one of two supplementary dams of the Grand River system, which is intended primarily for flood control. The Interior Department spokesman said the matter was not presented to that department, and explained that the War Department would have an interest in the matter since it is part of the Corps of Engineers plan for development of flood protection for the Arkansas River valley.

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makes your lighting system more efficient

Human eyes are industry's finest and best tools. But they are useless without light. And the amount and quality of light depend not only upon the light source but also upon reflection and diffusion.

Light-colored walls and ceilings long have been used to reflect and diffuse light. Today, light-colored *floors* also are being used to salvage waste light.

These new light-reflecting floors are built of concrete. They are made with Atlas *White* portland cement instead of *gray* portland cement or other darker materials. Hence they reflect more light —salvage waste light. This improvement in illumination—

- ▶ *reduces eyestrain, headaches, and absenteeism;*
- ▶ *decreases accidents, errors and spoilage;*
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Maintenance of white-cement floors is simple — frequent sweeping, occasional damp mopping, periodic scrubbing.

Send for new book, "Light From Floors." Write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

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Sales Opportunities

WASHINGTON—Washington Water P Co., Spokane, plans new power subs for distribution service in northern of city. Application has been made permit and work is to begin soon.

CALIFORNIA—War Department, W ington, D. C., has authorized new air force base, comprising hangars, and warehouses, with mechanical lines electrical equipment. Also will build sub-station with electrical distributio erating facilities. Project will include racks, mess hall and miscellaneous tures. Cost estimated about $1,00 Project will be supervised by U. S. D Engineer Office, Los Angeles.

NEW JERSEY—Alan Wood Steel Co. shohocken, Pa., has contracted with ernment for extensions in iron ore- properties, with installation of mecha and electrical equipment, and other erating facilities. Cost estimated $875,000, with financing by Defense P Corp. Work is to be carried out at on

FLORIDA—City Council, Pensacola, expansion in municipal airport, inclu new control tower, extensions and provements in lighting system, ins tion of an auxiliary lighting system other facilities. Cost about $100,000. will be carried out under direction Civil Aeronautics Administration, W ington, D. C., which has authorized for project.

OREGON—Columbia Shipbuilding & dock Co., Lewis Building, Portland, new shipbuilding and repair plan Columbia River, designed largely for war operations. It will comprise shipways, 400-ft. cargo and outfitting marine railway, machine and repair s boiler house, power substation and d bution lines. Cost reported over $1,00 with machinery and electrical equip Proposed to secure a priority rating begin work at early date. Alex Mechlin is general manager and engr

CALIFORNIA—Douglas Aircraft Co. Santa Monica, plans expansion in p in California and Michigan for produ for government, including additional ings with mechanical and electrical e ment. Cost estimated about $3,50 with financing by Defense Plant Work will be carried out at early

WASHINGTON—Puget Sound Pow Light Co., Seattle, has plans for power substation. A building permi been issued and work will be carri at once under direction of Stone & ster Engineering Corp., Lloyd Bu Seattle, engineer and contractor. N mate of cost announced.

OHIO—American Propeller Corp., Alexis Ave., Toledo, manufacturer plane propellers, will carry out exp in plant for production for govern including additional buildings, with chanical and electrical equipment. estimated about $900,000, with fina by Defense Plant Corp.

MISSOURI—Civil Aeronautics Ad tration, W. E. Kline, regional dir City Hall, Kansas City, plans call for early in 1944 for new airport, comp hangar, shop and other buildings,

trical and mechanical equipment. Also ting system, control station and other lities. Cost estimated about $600,000.

EW YORK—Buffalo, Niagara & Eastern er Corp., Buffalo, and affiliated com- ies in system of Niagara-Hudson Power p., New York, including Niagara Falls er Co., Niagara Falls, will make ex- ions in primary and secondary lines in l districts, covering areas classified WPB as essential to farm service for production. Project will include power stations, service connections and other rating facilities, with estimated cost bout $1,000,000. A preference rating be secured and work placed under way early date.

ASSACHUSETTS — War Department, shington, D. C., has approved plans new military base, comprising shops, ehouses and other buildings, with hanical and electrical equipment. Also er substation facilities, distribution s, service connections, etc. Entire proj- will cost over $1,000,000 and will be ervised by U. S. District Engineer e, Boston. Contract for building tion has been let to Rugo Construc- Co., Inc., 80 Boyleston St., Boston.

IRGINIA—Department of Public Utili- Radford, is arranging a post-war ex- sion program, including new steam- tric generating station, with capacity bout 2,500-kw., to supplement present icipal power plant. Cost estimated t $400,000. City also plans municipal erator plant and sewage disposal ks as post-war development, estimated ost over $150,000. H. T. Roberts is manager.

ASHINGTON—Pend Oreille Electric Co- rative, Inc., Newport, plans new trans- ion with secondary lines to rural dis- s, including line transformers, service nections and other operating facilities. lication has been made to State De- ment for franchise.

ICHIGAN — Mueller Brass Co., Port on, manufacturer of brass and copper ducts, rods, tubing, etc., will carry out ansion in plant for production for gov- nent, including additional buildings, machinery and electrical equipment. estimated about $1,500,000, with finan- by Defense Plant Corp. Work is duled to proceed at early date.

EORGIA—Columbus Municipal Airport artment, Columbus, has plans matur- for new multi-story control tower at icipal airport, estimated to cost about ,000, with electrical and mechanical pment. T. Firth Lockwood, Colum- is architect; W. H. Armstrong, Palmer ding, Atlanta, is engineer.

ORTH CAROLINA—French Broad Elec- Membership Corp., Marshall, is plan- early call for bids for construction ew hydroelectric power plant on French d River, Madison County, exclusive ydraulic turbine, generator and switch- , which will be secured under another ract. Financing has been arranged. J. McCrary Engineering Corp., 22 Marietta Building, Atlanta, Ga., is consulting neer.

EW YORK—New York State Electric & Corp., Ithaca, is reported planning steam-electric generating plant, to cost xcess of $1,800,000, with switchyard, smission lines, etc. Gilbert Associates, 412 Washington St., Reading, Pa., onsulting engineer. It is understood project will be for post-war maturity.

Please Be Patient

WE'RE SORRY. We know you may not be receiving your copy of ELECTRICAL WORLD on time and, wherever the trouble is within our own walls, we're turning handsprings to correct it. But much of the difficulty is entirely beyond our control, especially transportation. We are using special expediters to co-operate with the Post Office and the railroads, but that has merely kept deliveries from being worse than they are.

It isn't only the shipping out of the magazines, but the shipping in of paper, the shipping of engravings and proofs—a delay in any one of which means a delay of the whole product. And when a magazine is not ready another one takes its place on the press, with the result that it must then wait until a press is free. In other words, delays in printing these days are pyramided.

It is terribly embarrassing to have to acknowledge these delays because we have always prided ourselves in "coming out" on time, regardless. We will still do everything possible to try to improve conditions, but in the meantime we ask you to remember that both the railroads and the Post Office have had a tremendous load placed on them and are doing extraordinary jobs. We'll all do our best—please be patient with us.

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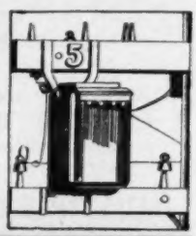

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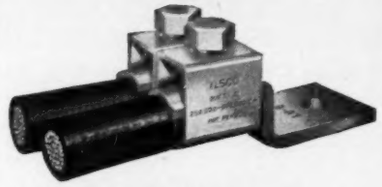

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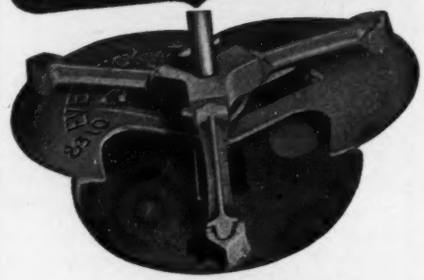

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Recent Rate Rulings

UTAH POWER & LIGHT Co. has obtained from the Utah Supreme Court a writ of review and a stay of the rate reduction which was to have become effective October 15. Court hearings are not expected to begin before the end of the year, but meanwhile the company will deposit monthly, sums equivalent to the amount of the rate cut in dispute. Invoking the fourteenth amendment to the United States Constitution and citing that Utah statutes stipulate "present value—not original cost" should be used in determining utility service rates, utility officials petitioned the court for a writ of certiorari and order staying the effective date of the state Public Service Commission's rate reduction order. Utility officials maintained that the commission's order does not "take into consideration the probable business conditions when war subsidies and the subsequent falling off of revenues" deprives the company of its property without "due process of law" in violation of the fourteenth amendment and similar provisions of the Utah constitution and denies to the company the equal protection of property granted to individuals and corporations under United States and Utah constitutions. Previous to the filing of the petition in supreme court, George M. Gadsby, president and general manager of Utah Power & Light Co., said: "We maintain that the reduction order is confiscatory and unwarranted. If Commissioner Donald Hacking's dissenting opinion to the original order had been adopted, we would not have been forced to take the case to the supreme court. A schedule submitted by the War Department, represented by officials of the Ninth Service Command, covering rates for electricity sold at ten military installations in Utah, was denied by the commission (ELECTRICAL WORLD, August 14, 1943, page 10, and October 16, 1943, page 149). In denying the Army's schedule, the commission stated it does not consider it necessary or advisable to prescribe or approve such a special military schedule of rates, adding "the army and navy establishments in Utah, of course, will receive, along with other consumers of the company, the benefits resulting from the reductions of rates and charges."

INDIANAPOLIS POWER & LIGHT Co. has made an annual rate reduction of $276,000 to small commercial consumers, according to the Indiana Public Service Commission. The reduction follows an agreement worked out by the commission and the utility. The order will serve to equalize rates between small commercial and residential users and will affect 14,000 consumers.

LOWER COLORADO RIVER AUTHORITY has announced rate reductions for six central Texas towns served by the authority. LCRA officials estimated that consumers' charges would be reduced $26,000 a year under the new scale. The percentage of reduction and estimated savings are as follows: San Marcos, 2.49 percent, $5,375; Lampasas, 4 percent, $5,879; Flatonia, 10 percent, $329; Lometa, 7 percent, $619; Llano, 5 percent, $1,252; and San Saba, 5 percent, $1,348. Rates at Kerrville were recently cut 15.63 percent by the authority, with an estimated $10,321 annual reduction to customers.

PUBLIC SERVICE ELECTRIC & GAS Co., Newark, N. J., has been directed by the state Board of Public Utility Commissioners to show cause why its commercial rates should not be revised. The board's order followed its announcement that the Pub-

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fast, reliable low-cost metal joining
BULLETIN 12-A

This new edition gives you the facts about Sil-Fos and Easy-Flo, the fast-acting, low-temperature silver brazing alloys that have revolutionized metal joining operations in many industries and have multiplied production, saved tons of metal, provided superior joints and cut costs on hundreds of jobs in planes, tanks, ships, guns, shells and other war equipment. It tells you **how to put Sil-Fos and Easy-Flo to work in your plant** and contains valuable information on joint designs, heating methods and production increasing procedures.

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Service company has agreed voluntarily to revise its schedule to grant lower rates to Fort Dix, Camp Kilmer and a few other large users of power for lighting purposes. Calling a hearing for January 20, the board stated it would determine whether existing commercial rates are "unjustly discriminatory or whether the present classifications are unreasonable."

ARIZONA CORPORATION COMMISSION, nullifying its original $175,000 electric rate reduction order to the Tucson Gas, Electric Light & Power Co. (ELECTRICAL WORLD, October 2, page 143), has issued a new order which it estimates will bring annual savings of $150,000 to the utility's customers.

GLOUSTER, OHIO, Board of Affairs has voted to increase the discount from 10 percent to 15 percent on municipal electric plant bills which are paid on time. This action was taken because so many delinquent accounts have been paid.

•

Says War Plastics Will Cut Home Fire Loss

Wire insulating materials whose flame resistance is a vital asset to Allied warships and tanks eventually will help cut down the number of home fires due to electric wiring faults, George Fowles of the B. F. Goodrich Co. told the annual convention of the Wire Association held recently at the La Salle Hotel in Chicago.

The exceptional "self-extinguishing" characteristics of some of the modern vinyl chloride thermoplastics, Mr. Fowles said, has been a chief factor in their adoption for wire and cable insulation by the Navy, which as a result has designed more severe flame tests than those previously used by industry. He said this property also has made feasible certain electric-wire-heated fabrics that were previously considered too dangerous.

Mr. Fowles stated that in the last five years the nation's wire and cable industry has been converted almost completely to the use of synthetic rubbers and thermoplastics for insulation and jacketing, after 50 years of continuous use of natural rubber for this purpose.

•

Foster Wheeler Dividend to Wipe Out Arrears

Directors of the Foster Wheeler Corp. have voted to clear up all arrears on its old $7 preferred stock with the declaration of a dividend of $14 a share for payment on December 1.

The board decided also to call this preferred stock on January 1 at $115 a share plus a dividend of $1.75 a share. There are 3,316 shares of the old preferred stock outstanding. Calling of the stock involves a distribution of $387,143, which includes the $1.75 dividend.

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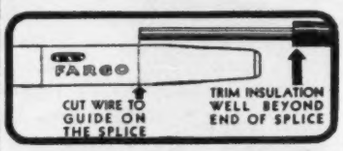

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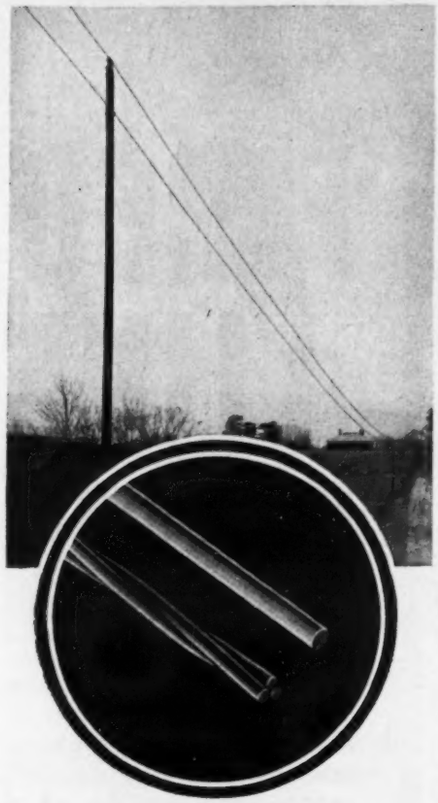

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LETTERS TO THE EDITOR

Vertical Foot-candles

To the Editor of ELECTRICAL WORLD:

Quite by accident I ran across your most interesting editorial in the April 17, 1943, issue of ELECTRICAL WORLD, pointing out the fallacy of referring to lighting installations as having such and such foot-candle value when these foot-candle values were measured or calculated on a horizontal plane. You point out that a considerable part of the work is usually done on a vertical plane and that references to foot-candle values should also include measurements or calculations on a vertical plane.

Work surfaces in industrial plants vary from horizontal up to horizontal down and from vertical up to vertical down in all planes. Usually the vertical foot-candles will vary considerable in different planes, and when a plane is tipped down instead of up the foot-candle values begin to really tumble. Such planes are quite common in die work and, of course, in airplane construction. This weakness in lighting is recognized as evidenced by recent experiments in white concrete floors and painting machine parts light colors.

No doubt the reason why so little reference is made to vertical illumination is that it is rather difficult to calculate, especially when the plane is somewhere between the horizontal and the vertical, and when it is at an angle to the direction of light.

DAVIS H. TUCK, Electrical Engineer,
Holophane Company, Inc.,
New York, N. Y.

[One of the Holophane engineers has recently developed a simple graphic device that will give the foot-candles on any plane in terms of the horizontal foot-candles. We hope to be able to publish something on this in the near future.—EDITORS.]

•

Against 220 Volts For Residences

To the Editor of ELECTRICAL WORLD:

Shocked, electrically shocked so to speak, was I when reading the editorial "Wiring Voltages" in ELECTRICAL WORLD of July 10. Against the suggestion to use 220 volts in residential buildings — however tentatively advanced—I can only cry: "No, and No again."

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84 Purchase St. Boston, Mass.

country I was in intimate contact h 220 volts—I mean with the prob- ns of safeguarding against its dan- rs. Believe me, 220 volts are no joke. e unending stream of publications on fety pouring out of Germany, Eng- nd, Switzerland—all such things as otective multiple earthing, earth-leak- e protection, and so on, may show at I do not exaggerate. I know that e dwellings over there are built from ick; that there is not such a thing as dry brick house, and that potential ngers here are minimized by the niversal wood construction (at least the country). Still I must say No.

When you come to this country for e first time the flimsiness of the 5- d 10-cent switches, outlets, plugs rikes you as almost unbelievable. fter a few years you realize that they e perfectly adequate, that they serve ell at 115 volts. Temperature and umidity are high in July and August still there is no reason for alarm, no ason for complaint.

Doubling the voltage, however, means complete and expensive redesign of tures, appliances and of the wiring stems in general. Moreover, it means ringent regulations. No switches, no tlets will be permitted inside the throoms; no more metal pull chains, c. New regimentation. Is this a de- rable post-war goal?

Apparently one has to come from less ortunate realms to appreciate the isdom and the happiness of this coun- y, which the native is only too prone overlook, or to take for granted.

LUDWIG F. ROEHMANN,
Hastings-on-Hudson, N. Y.

•

G.E. Surveys Stockholders on Post-War Radios

As part of General Electric Co.'s ost-war planning, an illustrated ques- onnaire asking the company's 227,000 tockholders what type of radio re- eiver they would like to buy after the ar has been mailed with the company's hird quarter dividend check. This sur- ey asks what kind of radio is now wned, if and when they plan to buy a ew receiver, the style and type pre- erred, and whether or not they know bout or are interested in FM.

Returns will be referred to the lectronics department's commercial esearch receiver division.

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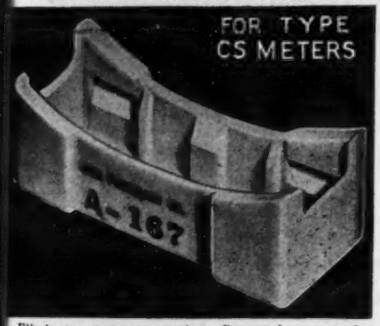

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BOOKS RECEIVED

Ambassador to Industry. By Clyde W. Park. The Bobbs-Merrill Co., New York. 324 pages. Price $3.50.

Industrialists and teachers alike will find refreshingly revealing this record of the evolution and fruition of Herman Schneider's program of co-operative technical education at Cincinnati. C. F. Kettering, early supporter of the pioneer movement, predicts universality for it and certainly this technical war is affording a crude equivalent to the men it withdrew temporarily from the cloistered halls. At Lehigh Scheneider became convinced that the student who worked his way took a more serious attitude in the classroom, and by 1904, now at Cincinnati, he formulated the plan after intensive discussions with the industries of the area. From then on it was a milestone in technical education, evolving by easy, unforced stages toward a nationally recognized success that brought the promoter the deanship and later an undesired presidency. The author, an intimate associate, further humanizes the biography by recording Schneider's war work in 1917, his hobbies and foibles, his consulting activities, his writings of poetry and short stories, his focus on organized industrial research.

Reference Data for Radio Engineers. Federal Telephone & Radio Corporation, 67 Broad Street, New York, N. Y. Price, single copy, $1, lots of 12 or more, 75 cents each.

Although this is a handbook, not a textbook, and is offered as an aid in radio research and development and in radio design and field engineering, its contents are such as to make it definitely useful to engineers concerned with electronic developments and applications apart from communications. Included are fundamental engineering and mathematical data of reference for electronic problems as well as formulas for high-frequency circuits, principles of tube design and methods of r.f. energy transmission.

Encyclopedia of Substitutes and Synthetics. By Morris D. Schoengold. Philosophical Library, New York. 382 pages. Price $10.

Eighty industrial and governmental laboratories contributed to this compilation of the properties of some 2,000 materials which can be substituted for critically short materials. Fields of current application are cited along with identification of substances which they replace. One valuable feature is a list of 300 trade names and another is a generic subject index (in which, for example, there are 42 items under "insulators" and "impreganants").

Hyper and Ultra-High-Frequency Engineering. By Robert I. Sarbacher and William A. Edson. John Wiley & Sons, Inc., New York. 664 pages, illustrated. Price $5.50.

Presupposes a course in conventional radio engineering. While rigorously mathematical, the treatment presents most helpful physical approach and representation of phenomena in the bracket 30-10,000 megacycles per second. Discusses in particular wave-guides, propagation, resonators, beaming, electron-transit time in tubes, the magnetron and the klystron as factors in the new art of microwaves.

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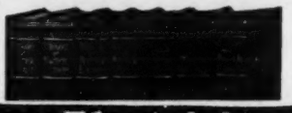

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2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
3—37½ KVA, General Electric, 2200/220/440.
2—30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—150 HP, 350/1050 RPM, Croccker Wheeler.
2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

INSTRUMENTS

25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

TURBO GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

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K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
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—1250	G.E.	720	250	2300
—1000	Whse.	900	600	2300
— 750	Whse.	1200	600	2300/4000
— 300	G.E.	1200	600	13200

Rotary Converters—3 Ph. 25 Cy.

—1500	G.E.	500	225/275	5600
— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

— 500	G.E.	720	600	2200
— 500	G.E.	720	600	13200
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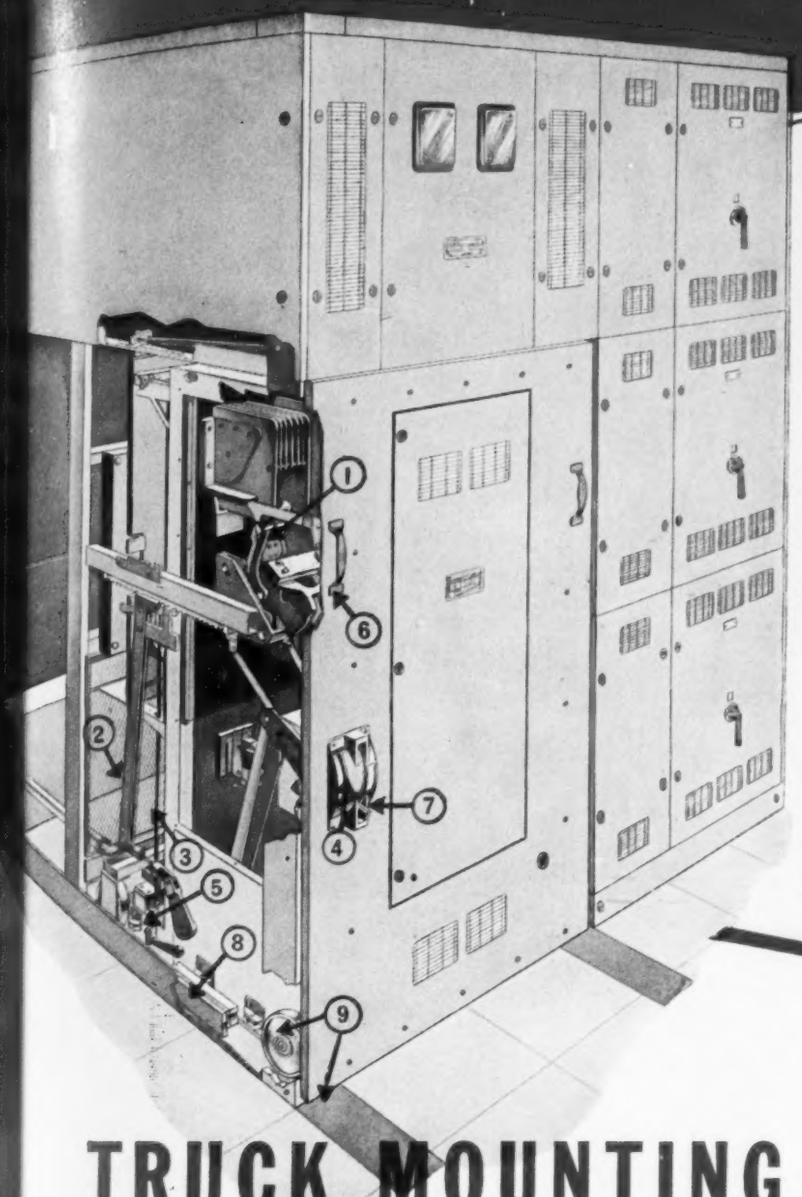
★ These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference



(1) **LARGE AIR CIRCUIT BREAKERS**—All drawout-type breakers, rated 2000 amperes and above, are mounted in trucks for easy handling.

(2) **DRAWOUT MECHANISM**—A simple, built-in mechanism, acting like a ratchet jack, withdraws truck to test position where disconnecting devices no longer restrain it. This mechanism also returns the truck into full contact.

(3) **REVERSING LINKAGE**—Reverses the "bite" of the pawls on the rack to change the direction in which the drawout mechanism moves the truck.

(4) **SOCKET FOR DRAWOUT LEVER**—The lever for operating the drawout mechanism is removed when not in use.

(5) **SAFETY TRIP**—Roller runs on a guide and prevents breaker being closed unless truck is fully inserted; or in test position; or withdrawn. It also trips the breaker if an operator attemps to insert the truck with breaker closed.

(6) **HANDLE FOR DRAWING TRUCK OUT OF HOUSING**—When the truck has been moved to the test position, a pull on this handle releases the connected latch, allowing complete withdrawal.

(7) **TRIP AND REVERSING LINKAGE HANDLE**—Raising this handle trips breaker open. This action also sets reversing linkage in "drawout" position. Pushing handle down moves linkage to "insert" position.

(8) **TRUCK GUIDE**—Guides, one on each side of housing, keep truck straight as it moves in or out.

(9) **RAILS AND WHEELS**—Rails are grouted in the floor flush with the surface. Ball-bearing wheels allow truck to be drawn out with very little effort.

TRUCK MOUNTING DETAILS IN I-T-E DRAWOUT SWITCHGEAR

Features identified above are concerned principally with the action of moving an I-T-E truck-mounted circuit breaker into the board or of drawing it out. There is some engineering to admire in the drawout arrangements for they mean safety to men and equipment and they mean ease of moving a husky assembly. Manufacture must be exact because, in many cases, spare trucks are kept at hand to assure continuity of service during inspection or maintenance periods, and spares must fit and act as neatly and positively as the trucks replaced. Many other features, besides the ones listed here, are standard in I-T-E practice. To have at hand a more complete presentation of them, send for Bulletin 4207—"Multumite Switchgear Assemblies, Drawout Type."

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

New Nonpareil Turbine Oil | Used Nonpareil Turbine Oil | New Conventional Turbine Oil | Used Conventional Turbine Oil

The samples pictured show new and Nonpareil Turbine Oil, and new and conventional oil which have operated under identical conditions. The dark color of used conventional oil sample shows the formation of soluble asphaltic and acidic substances, while the used Nonpareil has been stained by dirt in the circulating system.

Protection against both turbine deposits and corrosion

● IT IS NOT HARD to find an oil that will prevent corrosion. Some black oils have good rust-proofing qualities. Even used turbine oils have been found better than some new oils in this respect. But here's the difficulty. Oils that have natural corrosion-preventing qualities are not entirely suitable for turbines, because they may cause deposits. When these oils are refined to remove *all* the deposit-forming substances, the natural corrosion inhibitors are also taken out. Oils that give *complete* protection against both deposits and corrosion do not "grow." They must be *made*. Here's how the dual problem is solved in Nonpareil Turbine Oil.

Control of turbine deposits. Turbine oil troubles are caused chiefly by two types of hydrocarbons in oil—asphaltene and acid-formers. The elimination of these two types of trouble-makers is also a two-handled problem. The asphaltenes can be removed by highly refining the oil. But such refining increases the acid-forming tendencies. From this, it is evident that the use of highly refined oils alone merely means trading deposit problems for another type of problem.

The key to solving this problem was a unique inhibitor developed by Standard Oil for controlling acidity in an oil from which all asphaltene-formers have been removed. The use of this inhibitor under a patented process makes it possible for us to guarantee in writing that the acidity in Nonpareil Turbine Oil will not increase above the extremely low limit of 0.15 mgKOH/gm for the life of your turbine. The effectiveness of this method of eliminating deposits is demonstrated by turbine service records in which Nonpareil is still operating after 16 years without sweetening, treating, or replacing, and with no sign of troublesome deposits.

Control of corrosion. The problem of corrosion resistance in turbine oils, as stated before, is accentuated by the high degree of refining necessary to remove the asphaltene-formers. Such refining removes the natural corrosion inhibitors in the oil. Few inhibitors have been discovered which restore anti-corrosion properties without impairing other desirable qualities. This is also the objection to the addition of small amounts of used oils to fresh oils.

A corrosion inhibitor has been used in Nonpareil Turbine Oil since 1926. But a continuous study of this problem has been carried on. Hundreds of materials have been examined and thousands of tests made. An improved corrosion inhibitor is now used in Nonpareil which meets all requirements of corrosion protection without impairing other desirable qualities.

Recently the American Society for Testing Materials developed test D665-42T for determining the ability of turbine oil to aid in preventing the rusting of ferrous parts in the presence of water. Nonpareil Turbine Oil passes this test with perfect results.

Why Nonpareil eliminates both deposits and corrosion in turbines

1. Nonpareil is a highly refined oil from which all asphaltene-formers have been removed. This eliminates the most common type of deposit found when conventional turbine oils are used.

2. Nonpareil contains an inhibitor which prevents acidity increase, and is guaranteed not to exceed 0.15 mgKOH. This assures freedom from emulsions and deposits that occur when unprotected highly refined oils are used.

3. Nonpareil contains a thoroughly tested corrosion inhibitor, and passes the recognized test for corrosion prevention with a perfect test strip.

Get all the facts. A Standard Lubrication Engineer will be glad to supply test data and service records on Nonpareil. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Illinois. In Nebraska address Standard Oil Company, Nebraska at Omaha 2.

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★ NONPAREIL TURBINE OIL ★

STANDARD OIL COMPANY (INDIANA)

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★ LUBRICATION ENGINEERING